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PHOTOGRAPHY IN SCIENTIFIC RESEARCH - SELECTED BIBLIOGRAPHY AND --ETC(U)
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PHOTOGRAPHY IN SCIENTIFIC RESEARCH - SELECTED BIBLIOGRAPHY AND REFERENCE MATERIALS

AIR FORCE FLIGHT TEST CENTER
EDWARDS AIR FORCE BASE, CALIFORNIA

JULY 1976

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PHOTOGRAPHY IN SCIENTIFIC RESEARCH - SELECTED BIBLIOGRAPHY AND REFERENCE MATERIALS

AFFTC

July 1976

Final Report

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AIR FORCE FLIGHT TEST CENTER
EDWARDS AIR FORCE BASE, CALIFORNIA
AIR FORCE SYSTEMS COMMAND
UNITED STATES AIR FORCE

This handbook was submitted under Job Order Number SCN500 by the Directorate, Test Engineering and Services, of the Air Force Flight Test Center, Edwards AFB, California 93523.

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Scientific and engineering films result from the utilization of cinematography and photography as a research instrument, either as a reporting medium or as a data recording technique in the pure and applied sciences--the final result is in the form of "visual data". This annotated bibliography originated as a reference tool for Air Force Scientific and Technical Photographers and Optical Instrumentation Specialists assigned to the Photographic Branch, Photo

Instrumentation Section, Edwards Air Force Base, California. It contains a compilation of books, journal, periodical and newspaper articles and technical reports related to various aspects of scientific, technical and engineering photography to enable the photographer and test engineer to make competent judgements for applying photographic systems in research and development programs. It is also a survey of materials related to international photographic science and technology, particularly as conducted in such countries as the United States, France, England, Germany, Japan, and the Soviet Union. Last, it includes basic reference materials for understanding and solving many of the technical photographic problems that confront photographers and test engineers during the daily test activities conducted at the Air Force Flight Test Center and at the Air Force Rocket Propulsion Laboratory.

ACKNOWLEDGMENTS

The author is extremely grateful for the help given him by Miss Jean Dickinson, Chief Librarian, and her entire staff, to include, Mrs. Genevieve Cox, Mrs. Elizabeth Hill and Mrs. Carol Maples, of the Technical Library, Personnel Services Branch, the Air Force Flight Test Center, Edwards Air Force Base, California, without whose help this annotated bibliography would have been impossible. Selected materials not readily available were obtained through inter-library loan from the U.S. Library of Congress, Washington, D.C., the Center for Research Libraries, Chicago, Illinois, the University Research Library and the Engineering-Math-Sciences Library, University of California, Los Angeles, California and from various other industrial, scientific, state and federal organizations.

Sincere appreciation is also expressed to Dr. Robert Knudson, and Mrs. Alvista Perkins [retired], Doheny Library (Special Collections-Cinema) University of Southern California, Los Angeles, California, to Mr. Joe Saunders of the Red Lake Corporation and Mr Lew Webb [former employee of Red Lake Corporation] Santa Clara, California, and to the Society of Motion Picture and Television Engineers, Scarsdale, New York, for their outstanding help in obtaining additional selected materials for this study.

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PREFACE

Through the ages scientists and philosophers were forced to rely upon personal observations and memory during data gathering actions relative to truth-seeking activities. Of major difficulty to all parties concerned was the detailed evaluation of a body's motion and its existence in a time frame of reference.

Not until Joseph Nicephore Niepce invented photography in 1826 and Eadweard Muybridge devised sequential photography in 1872 was it possible for scientific investigators to analyze their subjects' actions in "non-real" time and movement. Further, much of today's use of photography in scientific endeavors can be directly traced to Dr. Ernst Mach's research of more than one hundred years ago where he used spark gaps to produce light in exposing silhouetted photographs of bullets and shock waves directly upon handmade glass photographic plates. In fact, the day has now arrived whereby photography is a common place, totally indispensable world-wide research and engineering tool. In truth, the flight testing of today's aeronautical and space vehicles would be difficult without the photographic medium.

Dr. Louis H. Cohen's exhaustive annotated bibliography of international materials and reference handbook dealing with subjects pertinent to research photography is a valuable addition to the literature of this increasingly complex field. And we who are associated with the photo instrumentation profession are grateful to Dr. Cohen for his personal time and effort consumed during its preparation.

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Gene C. Lemmon, Former Chief.
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Air Force Flight Test Center
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CHAPTER I

AERIAL AND UNDERWATER PHOTOGRAPHY

CHAPTER I

AERIAL AND UNDERWATER PHOTOGRAPHY

Actron: A Division of McDonnell Douglas Corp. Aerial Photographic Reference Handbook. [Publication TP 6458 Revised June, 1974]. Monrovia, Ca.: Actron, 1974. x+37pp. illus.

Contents: Computing Scale, Distance, and Height Above Terrain from Vertical Photographs; Hyperfocal Distance; Depth of Field; Forward Overlap, Cycle Interval, Forward Motion Compensation; Equations and Procedures for Aerial Photography Nomograph; Conversion Factors.

Arzhanov, E. Aerial Photographic Equipment. Translation of Mono. ["Aerofotosyemochnoe oborudovanie"]. Moscow: 1972. Chapters VII-Xii, pp. 94-183. [Report FSTC-HT-23-1305-73. Translated by Smith; Available from NTIS as Accession No. AD 786 801/1GA, 15 March 1974]. Charlottesville, Va.: Army Foreign Science and Technology Center, 1974. 149pp.

The two principle types of Russian Aerial Topographic cameras are described, as well as nontopographic slit, image shift compensation, panoramic and small-size aerial photos, methods for determining them, and the apparatus used, gyrostabilizer units, statoscopes, radioaltimeters, and radiogeodetic apparatus. Aerial Magnetometry, gamma radiometry and other special survey apparatus is briefly described. Composition, Installation, Operation, Maintenance, Documentation and Repair of Aerial Photographic Equipment is discussed and the final section is devoted to the history of aerial photography.

Brock, G. C. Evaluation of Aerial Photography. Focal Library Books, New York: Pitman Publishing Corp.,1970. 258pp.

______., et al. Photographic Considerations for Aerospace. 2nd ed. Edited by H.J. Hall and H.K. Howell. Lexington, Mass.: Itek Corporation, 1966. 122pp.

The purpose of this book is to communicate to nonphotographic scientists, engineers and technicians some of the basic technical considerations for high altitude photography. Data on films for aerospace use are presented together with

details on ground scene illumination, atmospheric luminance and the practical aspects of the photorecording process. It is intended to demonstrate photographic considerations involved in the problem of recording an accurate likeness of the ground scene and provide an understanding of the way in which photographic material can be used for improving aerial camera system performance.

Eastman Kodak Company. Bibliography on Underwater Photography and Photogrammetry. Kodak Publication No. P-124. Rochester, N.Y.: Eastman Kodak Company, 1972.

_______. Kodak Aerial Exposure Computer. Kodak Publication No. R-10. Rochester, N.Y.: Eastman Kodak Company, 1970.

_______. Photo Interpretation and its Uses. Publication No. M42. Rochester, N.Y.: Eastman Kodak Company, 1969.

_______. Proceedings of the Kodak Seminar--Aerial Photography as a Planning Tool. Publication No. M-128. Rochester, N.Y.: Eastman Kodak Company, 1974.

Presents papers on the acquisition, management and use of data pertinent to land use and natural resources inventory. Papers include: Aerial Photography in a Systems Approach to Land Development Analysis; A Practical Method for the Collection and Analysis of Housing and Urban Environment Data. An Application of Color Infrared Photography; State Planning and the Land-Use Policy Act., etc.

_______. Properties of Kodak Materials for Aerial Photographic Systems, Vol. I. Kodak Aerial Films and Photographic Plates. Kodak Publication No. M-61. Rochester, N.Y.: Eastman Kodak Company, 1972. 28pp.

_______. Properties of Kodak Materials for Aerial Photographic Systems. Vol. II. Physical Properties of Kodak Aerial Films. Kodak Publication No. M-62. Rochester, N.Y.: Eastman Kodak Company, 1972. 32pp.

_______. Properties of Kodak Materials for Aerial Photographic Systems. Vol. III. Physical and Chemical Behavior of Kodak Aerial Films. Kodak Publication No. M-63. Rochester, N.Y.: Eastman Kodak Company, 1974.

Fisher, R. W., and Rosenfeld, A. "Camera Design and Optimization by Computer (for Aerial Photography)," Proceedings of the IEEE. [National Aerospace and Electronics Conference, Dayton, Ohio., May 13-15, 1974]. pp. 197-202.

The model analyzes the performance using modulation transfer function techniques and determines the volumes and altitutd range. Through an iterative procedure the focal length is computed, which

provides the required ground resolution. The minimum operating altitude and camera size are computed. The process is repeated for six camera types, four film types, four film widths, seven aperture numbers and all combinations of supporting subsystems, which include four types of image motion compensation, four focus control methods, five vibration isolator types, and two thermal control methods.... The computer programme may be interrogated for detailed dimensions suitable for preliminary camera layout. The results show that ...reduction in camera size can be achieved over existing designs with similar performance.

Frey, H., and Tzimoulis, P. Camera Below: The Complete Guide to the Art and Science of Underwater Photography. New York: Association Press, 1968. 224pp.

Goddard, George W., and Copp, DeWitt S. Overview: A Life Long Adventure in Aerial Photography. Garden City, N.Y.: Doubleday and Co., 1969. 415pp. illus.

Gonon. G. B., et al. Kosmicheskaya fotosyemka i geologicheskiye issledovaniya. ("Space Photography and Geological Studies"). Leningrad: "Nedra," Leningrad Section. 1975. 416pp.

Describes theoretical and practical problems of space photography, space photogrammetry and geological decipherment of space photographs. It presents consideration of production of images of a diurnal surface from spacecraft. Special attention is given to the effect of the atmosphere on image qualities. Results of subsatellite experiments involving simultaneous photographing of some parts of the earth from space and from an airplane are presented. Stereophotgrammetry of space photographs is considered.

Heiman, Grover. Aerial Photography: The Story of Aerial Mapping and Reconnaissance. Air Force Academy Series. New York: New York: Macmillan Publishing Co., Inc., 1972. illus.

Jerlov, N.G., and Nielsen, E. Steeman., eds. Optical Aspects of Oceanography. New York: Academic Press, Inc. 1974. 510pp.

Contents: Optical properties of pure water and pure sea water; Observed and computed scattering functions; Refraction and reflection of light at the sea surface; Significant relationships between optical properties of the sea; Structure of solar radiation transfer in the oceans; Underwater visibility and photography; Polarization measurements in the sea; Optics of turbid waters (Results of Laboratory Studies); Some applications of dissolved organic matter in the sea; The use of fluorescent dyes for turbulence studies in the sea; Remote optical sensing in oceanography utilizing satellite sensors; The remote sensing of spectral radiance from below the ocean surface; Light and photosynthesis of different marine algal group; Light and primary production; Remote spectroscopy of the sea for biological production studies; Underwater light and the orientation of animals; Bioluminiscence.

MacCraw, Robert B. [Major, USAF]. The Emerging Role of Intelligence Production. [Report No. 1645-74, A Research Study Submitted to the Faculty of Air Command and Staff College]. Maxwell AF Base, Alabama: Air University, 1974. iv + 46pp.

Discusses the growing importance of imagery derived strategic intelligence...by tracing the development of photo reconnaissance collection and exploitation from its origin as a battlefield surveillance tool through its evolution into an indispensable source of strategic and national intelligence. Contents: Abstract; List of Illustrations. Chapter 1. Introduction (Objective, Limitations, Assumptions, Significance of Subject); II. Background (Origin of Aerial Reconnaissance, Aerial Reconnaissance in WWI, Aerial Reconnaissance in WWII, Post War Developments and their Impact on Imagery Intelligence Activities. (New Sensors for Aerial Reconnaissance, New Collection Platforms, Impact on Exploitation Capability); IV. Conclusions.

McDonald, Kendall. Fish-Watching and Photography. New York: Charles Scribner's Sons, Inc., 1974. 270pp. illus.

A manual for underwater photographers, pleasure divers and scientists. Provides useful tips for underwater situations and practical techniques for getting close to fish. Consists of two main parts: An extensive guide to underwater photography with detailed advice on equipment and techniques; and a catalog of fish by species, subdivided into Northern, Mediteranean and Tropical waters and further subdivided into habitats. Practical lessons in underwater photography include photography at wreckage sites, problems with particular fish, composition, constructing underwater housings, etc. [Color and B/W Illustrations Included].

McNeil, Gomer T. Optical Fundamentals of Underwater Photography. 2nd ed. Rockville, Maryland: Mitchell Camera Corp., Photogrammetry Division, 1972. 119pp. illus.

Informative and useful to underwater photographers and system designers interested in theperformance of lenses and ports. Basic terms are clearly defined as well as relationships of optical performance to basic principles. Contents: Object and image distance relations for thin and thick lenses, flat and dome ports, distortion, depth of field, lens speed and camera calibration, analysis of the optical system of an underwater panoramic camera serves as a practical review. The author also introduces materials to problems related to attenuation and scattering of light in water.

Mertens, Lawrence E. Inwater Photography: Theory and Practice. New York: John Wiley & Sons, Inc., 1970. 391pp.

Contents: Introduction. Transmission of Light in Water; Image Contrast; Applications of Filters; Supplemental Lighting; Lenses and Optical Ports; Cameras with Water Tight Housings; Photographic Films and Image Tubes; Biological Aspects of Light and Color in the Sea; In-Water Photographic Systems and Applications; etc.

Mikhailov, A.E., and Ramm, N.S. Aerometody pri geoligicheskikh issledovaniiakh ("Airborne Methods in Geological Investigations"). Moscow: "Nedra," 1975. 199pp. 35 refs.

The apparatus commonly used to obtain aerial photographs and satellite imagery suitable for use in geological studies are described. . . . Special attention is given to the use of aerial and satellite imagery to locate mineral resources. The construction of geological maps from aerial and satellite imagery is discussed.

Newhall, Baumont. Airborne Camera: The World From Air and Outer Space. New York: Hastings House, 1972. 144pp. illus.

Photography: Rapid Photographic Processing and Underwater Photography. Vol. I of III Vols. A DDC Bibliography. Accession AD 693 000. Alexandria, Va.: US DDC, Cameron Station. 1969. 82pp.

Volume II. AD 858 900 (U); Volume III. AD 858 950.
Deals with the technique of underwater photography and rapid photogaphic processing. Covers articles in the DDC collection from January 1953 to March 1969.

Rebikoff, Dimitri and Cherney, Paul. Underwater Photography. 2nd ed. New York: Amphoto, 1975. 143pp. illus.

Reconnaissance Laboratory. McDonnell Aircraft Co. Reconnaissance Reference Manual--1973. St. Louis, Mo.: Reconnaissance Laboratory, McDonnell Aircraft Company, 1973. 225pp.

Contents: Aircraft and Sensors (Cameras, Mounts, Lenses), Mission Planning, Films, Film Processing and Processors, Image Interpretation, General Materials. Index, pp. 221-225.

Rogov, Aleksandr Aleksandrovich. Fotos"yemka pod vodoi. ("Underwater Photography"). Moscow: Izd-vo, "Nauka," 1964. 104pp. illus.

From the Authoı; With a Camera Underwater; Optical Properties within Water and the Laws Affecting it in its light; Selection of Objectives for Underwater Photographic Apparatus; Special Forms of Underwater Photography; Conclusion. Tables, and References.

Ross, D.S. Experiments in Oceanographic Aerospace Photography. III. Some Films and Techniques for Improved Ocean Image Recording. Final Report. 4 August 1974. Mountain View, Calif.: International Imaging Systems. Accession COM-75-10593/2GA. Springfield, Va.: NTIS, 1974. 68pp.

It is believed that photographic materials, equipment and techniques are available for achieving very significant improvements in blue and green ocean image recording, and that a multispectral system can be standardized for operational use with a

minimum of further development. It was concluded that acquiring blue and green multispectral imagery of ocean subjects with films such as Royal Ortho 2569 is operationally feasible, and that such images contain, by several factors, more spectral and spatial information than with conventional aerial black-and-white or color films. Water penetration is significantly improved, and water color differences are much enhanced. Information is secured which is not recorded at all on standard emulsions. Contrast degradation effects of atmospheric and water hazes are greatly diminished.

Simakova, M. S. Soil Mapping by Color Aerial Photography. [Academy of Science of the U.S.S.R., Dokuchaev Soil Institute]. Jerusalem: Israel Program for Scientific Translations, 1964. 81pp. illus.

A translation of "Metodika kartirovan'ya pochv prikaspiiskoi nizmennosti po materialam aerofotos"emki" in Pochvanno-Geograficheskie issledovaniya i ispol'zovani pochu. Moscow: Izd-vo, Akademii nauk, sssr, 1959.

Contents: Utilization of aerial photography in various branches of the economy. Aims of the present work. Material used in Aerial Photography. Chapter I. Soil Cover of the Region; II. Interpretation of the Soil Cover of the Region from Aerial Photography; III. Method of Soil Mapping with Aerial Photographs; Conclusion, p. 71. Bibliography, p. 78. List of Abbreviations, p. 81.

Smirnov, A. Ya., et al. "Film for the Aerial Photography of Subjects with Wide Brightness Ranges," Zhurnal nauchnoi i Prikladnoi fotografii i kinematografii ("Journal of Scientific and Applied Photography and Cinematography"), Vol. XIX, No. 5 (September-October, 1974), pp. 338-340. [in Russian].

A new film is described comprising two layers of panchromatic light sensitive materials of differing spectral characteristics. Colour components are included in each layer and a colour development technique is employed. The positive process can be in colour or black-and-white. An example of a print with the new film is given [1 reference].

Society of Photo-Optical Instrumentation Engineers. Seminar on Underwater Photo-Optical Instrumentation Applications. [S.P.I.E., Seminar Proceedings, Vol. 12. February 5-6, 1968, San Diego, Calif.; Co-Sponsored by the U.S. Department of the Navy]. Redondo Beach, Calif.: Society of Photo-Optical Instrumentation Engineers, 1968. 194pp.

______. Seminar on Underwater Photo-Optics. [S.P.I.E. Seminar Proceedings, October 10-11, 1966, Santa Barbara, California]. Redondo Beach, Calif.: S.P.I.E., 1966.

______. Underwater Photo-Optical Instrumentation Applications. [Proceedings of the S.P.I.E., Seminar in Depth. March, 1971, Edited by S.Q. Duntley, et al.].Redondo Beach, Calif.: S.P.I.E., 1972. 168pp. illus.

Spravochnik letchika i shturmana. ("A Manual for Pilots and Navigators"). Moscow: Izd-vo, Voyenizdat, 1974. 512pp.

Generalized and systematized information on aviation meteorology, construction of aircraft and their engines, aero dynamics and dynamics of flight, air navigation, aviation astronomy and mapping, maneuvering and guidance, bombing and aerial photography, and systems of automatic flight control.

Contents: Section 1. Aviation Meteorology; 2. Construction of Aircraft; 3. Aircraft Engines; 4. Aerodynamics and Dynamics of Flight; 5. Aviation Astronomy; 6. Aviation Cartography; 7. Air Navigation; 8. Automatic Flight Control Systems of Airplanes;9. Maneuvering Airplanes and Interairplane Navigation; 10. Bombing, Military Use of Aviation Winged Rockets, Sighting Release of Slowly Falling Bodies; 11. Aerial Photography; Index.

Strandberg, Carl H. Aerial Discovery Manual. New York: John Wiley & Son's, Inc., 1967. 249pp. [paper].

Strykowski, Joe. Divers and Cameras. A complete textbook for Students, Instructors and Advanced Underwater Photographers. illustrated by Ernie Duerksen. Northfield, Ill.: Dacor Corp., 1974. iv + 212pp. illus.

Wallin, Douglas. Basics of Underwater Photography. New York: Amphoto, 1975. 136pp. illus.

Analysis of the Equipment; Shooting Techniques; Films and Filters that work best; Natural & Artificial Light; Underwater closeups. Darkroom Techniques.

Wolf, Paul R. Elements of Photogrammetry (With Air Photo Interpretation and Remote Sensing). New York: McGraw-Hill Book Company, Inc., 1974. 562pp. illus.

Discusses such topics as cameras, photographic geometry, stereoscopy, parallax, radial-line triangulation, flight planning, ground control and stereoscopic plotting instruments.

Coverage is also provided on such subjects as orthophotos, terrestrial photos, oblique photos, panoramic photos, photogrammatric optics, control extension by photogrammetric bridging, photographic interpretation and remote sensing. A selected list of references is given at the end of each chapter.

A modern introduction concerned with the broad and dynamic field of photogrammetry.

CHAPTER II

HIGH SPEED PHOTOGRAPHY: APPLICATIONS, EQUIPMENT, PRINCIPLES AND PROCESSES

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HIGH SPEED PHOTOGRAPHY: APPLICATIONS, EQUIPMENT, PRINCIPLES AND PROCESSES

Aspden, Ralph L. Electronic Flash Photography. New York: The Macmillan Co., 1960. 192pp.

The author includes design and application data, an equipment summary as well as descriptions of several specialized techniques.

Chesterman, W. Deryck. The Photographic Study of Rapid Events. London: Oxford University Press, 1951. 168pp. + xii pages and 32 full pages of plates.

The ninth volume in the series entitled: "Monographs on the Physics and Chemistry of Materials." Deals with various techniques that may be employed and discusses the conditions of speed, lighting, repetition and sensitivity which influence the photographic study of events which occur in two short a duration of time to be visually observed. Chesterman also provides the reader with some of the problems to which various techniques have been applied.

Subjects include a diverse selection of materials such as: The study of a flight of birds and insects; Photography of fish in their natural habitat; Cine-Radiographic Films of joint movements; Investigation of high-speed machine tool performance, and military applications--photography of air flow past projectiles, performance of underwater weapons, and detonations of explosive charges both under water and in the air.

Two thirds of the book deals with the photographic techniques used to study rapid events, one third reviews the applications of the methods in various sciences and suggests ways in which the techniques and modifications of them may be further applied in research. Includes 196 references and 32 excellent photographs.

Cohen, Louis Harris. Photographic Instrumentation Methods and Techniques for Rocket Sled and Track Testing in Research and Development Projects. Technology Document No. 73-3. June, 1973. Edwards Air Force Base, Calif.: Scientific & Technical Information Office [STINFO], 1973.

Conrady, A.E., et al. Photography as a Scientific Implement. New York: Van Nostrand, 1923. 549pp. illus.

Contents: I. The History of Photography. II. The Elementary Optics of Photography. III. Photographic Optics. IV. The Theory of Photographic Processes and Methods. V. Astronomical Photography. VI. Application of Photography in Physics. VII. Photography in the Engineering and Metallurgical Industries. VIII. Photo Micrography. IX. Photographic Surveying. X. Aeronautical Photography. XI. Color Photography. XII. Photography Applied to Printing. XIII. The Technics of Kinematography. XIV. The Camera as a Witness and Detective.

Courtney-Pratt, J.S. Some Unconventional Methods of High-Speed Photography. [Bell Telephone System Technical Publications Monograph 4076]. New York: Bell Telephone Laboratories, Inc., 30pp. illus. [Also published in the Proceedings of the Fifth International Congress on High-Speed Photography, 1962. pp. 197-226].

Cruise, John and Newman, A. Photographic Techniques in Scientific Research. Vol. I. New York: Academic Press, Inc., 1973. 356pp. illus.

New and improved applications of photographic techniques in scientific research: Photography of Marine Life; The Application of Photography to Soil Mapping from the Air; Photography of Insects and in Palaeontology.

Dubovik, Aleksandr Semenovich. Fotograficheskaya registratsiya bystroprotekayushchikh protsessov. Izdaniye 2-ye, pererabotannoye. ("Photographic Registering of Rapidly Developing Processes"). Moscow: Izd-vo, "Nauka," 1975. 456pp. illus.

This book deals with the actual problem of registering and investigation of rapidly developing processes in the contemporary science and technology. Discussions relate to the use of high-speed photography in the studies of aero-dynamic, gas dynamic and hydrodynamic processes, explosions, burning, plasma states, function of lasers, etc.

Table of Contents: Foreword to the Second Edition, p. 3. Introduction: Classification of the Methods and Devices of High-Speed Photography, p. 5; Part 1. Photographic Registering of Rapidly Developing Processes by Means of Slot Scanning, p. 13; Part 2. Photographic Registering of Rapidly Developing Processes by High-Speed Photographic Cameras, p. 78; Part 3. Special Methods of Photographic Registering of Rapidly Developing Processes, p. 254; Part 4. Auxiliary Devices and Materials used in High-Speed Photography, p. 380. Bibliography, p. 436.

The First Edition, 1964. 466pp., is available in two English Language Translations. 1. NASA TT-F-377 1965, 372pp. illus.;

2. Photographic Recording of High-Speed Processes, New York: Pergamon Press, 1968. 468pp. illus.

Eastman Kodak Co. High Speed Photography. Publication No. G-44. Rochester, New York: Eastman Kodak Co., 1976. 60pp. illus.

A guide for people who are using high-speed photography for the first time. Explains special knowledge required, and equipment involved. Includes discussion on various types of high-speed cameras, how they operate, useful techniques, films and their physical and sensitometric characteristics and a reference list of camera manufacturers.

Edgerton, Harold E. Electronic Flash, Strobe. New York: McGraw-Hill Book Co., 1973. 384pp. illus.

Theory and practical applications of flash systems. Contents: Theory of the Electronic Flashlamp. Spectral Output of Flash Lamps. Circuits for Electronic Flash Equipment. Electronic Flash Lighting Requirements for Photography. Electronic Flash Equipment (Single Flash). Electronic Flash Equipment of Short Exposure Time. Electronic Flash Equipment for Nature Photography. The Stroboscope. Exposure Calculations and Special Photography. Techniques of Light Measurements. Specialized Applications. Experiments and Experiences. Manufacturers and Suppliers of Electronic Flash Equipment.

________., and Killian, James R. jr. Flash! Seeing the Unseen. Ultra-High Speed Photography. 2nd ed. Newton, Mass.: Charles T. Branford Co., 1954. 215pp. illus.

An excellent collection of original high-speed photographs as well as a stimulating wealth of ideas.

Fayolle, P., and Naslin, P. Photographie instantanee et cinematographie ultra-rapide. Paris: Editions de la Revue d"Optique, 165 Rue de Sevies, 3 et 5, Boulevard Pasteur, 1960.

An excellent technical treatise on high-speed photography. The authors principly draw from problems related to photography of weapons, the behavior of projectiles, and the problems of lighting and timing this class of moving objects.

Section 1. Deals with optical and photographic techniques suitable for making informative records irrespective of the complications introduced by rapid motion--this includes the elements of photography by reflection and transmission (divided into methods--by shadows and by silhouette), the methods of striations, interference methods and photoelastic observation.

Section 2. Instantaneous photography with reference to the methods listed in Section 1. Describes various sources of instantaneous radiation, discusses electrical circuits-controls.

Section 3 is devoted to the applications of these methods and devices to the ultimate, most complex problem, that of ultra-rapid cinematography. Section 4 treats the problem of chronometry. This book contains a wealth of detailed working information, formulas, tables, and diagrams. Index is not included. Contains full table of contents and a good bibliography.

Greenewalt, Crawford H. Hummingbirds. New York: Doubleday & Co., 1960. 250pp. illus.

A collection of 67 color plates of photographs using stroboscopic flash lighting of thirty-millionths of a second and motion picture equipment with a framing rate of 2400 fps. Concludes with chapter on Methods and Equipment.

Hadland, R. "Recent Advances in High-Speed Photography," [Lecture presented at the Technical Seminar of the British Electro Optics and Laser Equipment Exhibition, Tokyo, December, 1975. Also printed in the Survey of British Electro-Optics, published by Taylor and Francis Ltd in collaboration with SIRA]. 1975. 5 refs.

High-Speed Aerodynamics and Jet Propulsion. Vol. VIII. High-Speed Problems of Aircraft and Experimental Methods. Editors, Pt. 1. A.F. Donovan, H.R. Lawrence; Pt. 2 & 3. F.E. Goddard; Pt. 4. R.R. Gilruth. Princeton, New Jersey: Princeton University Press, 1961.

Section O. A.C. Charters. Free Flight Range Methods, Chapter 1. The Free Flight Range. Section O.6. Spark Photography Apparatus, pp. 911-917.

High-Speed Photography. Vol. 1 [Symposium held in Washington, D.C. on October 29, 1948; Foreword by John H. Waddell]. New York: Society of Motion Picture Engineers, 1949. 129pp.

Contents: Foreword, John H. Waddell, p. 3; What is High-Speed Photography? Maynard L. Sandell, p. 5; Electrical Flash Photography, Harold E. Edgerton, p. 8; New High-Speed Stroboscope for High-Speed Motion Pictures, Kenneth J. Germeshausen, p. 24; Lamps for High-Speed Photography, R.E. Farnham, p. 35; Motion Picture Equipment for Very High-Speed Photography, Brian O'Brien and Gordon G. Milne, p. 42; Methods of Analyzing High-Speed Photographs, Wade S. Nivison, p. 49; New Developments in X-Ray Motion Pictures, C.M.Slack, L.F. Ehrke, C.T. Zavales, and D.C. Dickson, p. 61; High-Speed and Time-Lapse Photography in Industry and Research, Henry M. Lester, P. 71; Use of High-Speed Photography in the Air Forces, E.A. Andres, Sr., p. 81; High-Speed Photography in the Automotive Industry, Richard O. Painter, p. 90; Applications of High-Speed Photography, Max Beard, p. 97; Control Unit for Operation of High-Speed Cameras, L.L. Neidenberg, p. 107; Lenses for High-Speed Motion Picture Cameras, Alan A. Cook, p. 110; High-Speed Photographic System Using Electronic Flash Lighting, William T. Whelan, p. 116.

High-Speed Photography. Volume 2. Foreword by John H. Waddell. New York: Society of Motion Picture Engineers, 1949. 177pp. illus.

Contents: Foreword, John H. Waddell, p. 3; Motion Pictures in the Guided-Missile Program, H.M. Cobb, p. 5; High-Speed Motion Picture Photography, p. 14; High-Speed Motion Pictures by Multiple-Aperture Focal-Plane Scanners, Fordyce E. Tuttle, p.25; Improvements in High-Speed Motion Pictures by Multiple-Aperture Focal-Plane Scanners, Fordyce E. Tuttle, p. 36; Twenty-Lens High-Speed Camera, Charles W. Wyckoff, p. 43; Half-Million Stationary Images per Second with Refocused Revolving Beams, C.D. Miller, p. 53; Very-High-Speed Drum-Type Camera, K.M. Baird and D.S.L. Durie, p. 63; Design of Rotating Prisms for High-Speed Cameras, John H. Waddell, p. 70; Recent British Equipment and Technique for High-Speed Cinematography, G.A. Jones, and E.D. Eyles, p. 76; Bowen Ribbon-Frame Camera, E.E. Green and T.J. Obst, p. 89; Physical Optic Analysis of Image Quality in Schlieren Photography, H. Jerome Shafer, p. 98; Exposure Meter for High-Speed Photography, E.T. Higgons, p. 119; Techniques in High-Speed Cathode-Ray Oscillography, C. Berkley and H.P. Mansberg, p. 123; Measuring Shock with High-Speed Motion Pictures, J.T. Muller, p. 153; High-Speed Motion Pictures in Full Color, Frankoin M. Tylee, p. 162; Water-Cooled High-Pressure Mercury-Discharge Lamp for Direct-Current Operation, W. Elenbaas and E.W. van Heuven, p. 168; New View Finder for the Fastax Camera, Alfred L. Lidfeldt, p. 172; Report of High-Speed Photography Committee, p. 176.

High-Speed Photography. Volume 3. Foreword by John H. Waddell. New York: Society of Motion Picture and Television Engineers, 1951. 159pp. illus.

Contents: Foreword, John H. Waddell, p. 3; A Survey of High-Speed Motion Picture Photography, Kenneth Shaftan, p. 5; Electrical and Radiation Characteristics of Flashlamps, H.N. Olsen and W.S. Huxford, p. 29; Infrared Photography with Electric-Flash, Frederick E. Barstow, p. 43; The Stroboscope as a Light Source for Motion Pictures, Robert S. Carlson and Harold E. Edgerton, p. 54; High-Speed Photography of Reflection-Lighted Objects in Transonic Wind Tunnel Testing, E.R. Hinz, C.A. Main and Elinor P. Muhl, p. 67; The Pressurized Ballistics Range at the Naval Ordnance Laboratory, L.P. Gieseler, p. 81; A 100,000,000 Frame Per Second Camera, M. Sultanoff, p. 88; Photography in the Rocket-Test Program, Carlos H. Elmer, p. 97; The High-Speed Photography of Underwater Explosions, Paul M. Fye, p. 106; A Simplified Body-Cavity Camera, A.P. Neyhart, p. 117; The Cine Flash--A New Lighting Equipment for High-Speed Cinephotography and Studio Effects, H.K. Bourne and E.J.G. Beeson, p. 124.

Bibliography on High-Speed Photography, Including Schlieren and Cathode-Ray Oscillograph Photography, p. 138.
Cumulative Index, p. 157.

High-Speed Photography. Volume 4. Foreword by John H. Waddell. New York: Society of Motion Picture and Television Engineers, 1952. 170pp. illus.

Contents: Foreword, John H. Waddell, p. 3; Progress in Photographic Instrumentation in 1950, Kenneth Shaftan, p. 5; Three-Dimensional Motion Picture Applications, R.V. Bernier, p. 51; A High-Speed Stereoscopic Schlieren System, John H. Hett, p. 65; High-Speed Motion Picture Cameras from France, Paul M. Gunzbourg, p. 70; Letters to the Editor, John C. Kudar and John H. Waddell, p. 77; Optical Problems in High-Speed Camera Design, John C. Kudar, p. 81; A Rapid-Action Shutter with no Moving Parts, Harold E. Edgerton and Charles W. Wyckoff, p. 85; Use of Image Phototube as a High-Speed Camera Shutter, Alsede W. Hogan, p. 94; High-Constant-Speed Rotating Mirror, J.W. Beams, E.C. Smith and J.M. Watkins, p. 101; Light Source for Small-Area High-Speed Motion Picture Photography, Richard I. Derby and Arthur B. Neeb, p. 111; Cine-Interval Recording Camera (Automax), Arthur P. Neyhart, p. 113; Simultaneous High-Speed Arc Photography and Data Recording with a 16-mm Fastax Camera, Eugene L. Perrine and Nelson W. Rodelius, p. 120; Slide Rule for Analyzing High-Speed Motion Picture Data, Karl W. Maier, p. 125; Film Reader for Data Analysis, Walter M. Clark and Lee R. Richardson, p. 137; A Time-Motion Study by Methods of High-Speed Cinematography, Henry W. Baer, Bernard F. Cohlan and Arthur R. Gold, p. 143; Practical Application of High-Speed Photography in Business Machines, Willard L. Hicks and Robert L. Wright, p. 149; Continuous Processing Machine for Wide Film, Herbert E. Hewston and Carlos H. Elmer, p. 157; Cumulative Index, p. 167.

High-Speed Photography. Volume 5. Foreword by John H. Waddell. New York: Society of Motion Picture and Television Engineers, 1954. 359pp. illus.

Papers published in this volume is largely related to the First International Symposium on High-Speed Photography held in Washington, D.C., during October, 1952.

Foreword, p. 3; DESCRIPTION OF CAMERA EQUIPMENT. Isotransport Camera for 100,000 Frames per Second; Full-Frame 35mm Fastax Camera; Rapid-Sequence Camera Using 70mm Film; The BRL-NGF Cinetheodolite; A Microsecond Still Camera; 70mm Test Vehicle Recorder; A High-Speed Rotating-Mirror Frame Camera; X-Ray Motion Picture Camera and Printer for 70mm Film; Transient Pressure Recording with a High-Speed Interferometer Camera; The M-45 Tracking Camera Mount.

DESCRIPTION OF ACCESSORY EQUIPMENT. A Method of Lighting Large Fields for High-Speed Motion Picture Photography; Optical Aids for High-Speed Photography; Explosive Argon Flashlamp; Simple Electronic Devices for High-Speed Photography and Cinematography; Application of Wide-Angle Optics to Moderately High-Speed Motion Picture Cameras; Optical Techniques for Fluid Flow; Glow Lamps for High-Speed Camera Timing; Photographic Instrumentation of Timing Systems; APPLICATIONS OF HIGH-SPEED PHOTOGRAPHY. Photographic Instrumentation in the Study of Explosive Reactions; Motion Photography for Combustion Research; High-Speed Cine-Electrocardiography; Use of a Rotating-Drum Camera for Recording Impact Loading Deformations; X-Ray Motion Picture Techniques Employed in Medical Diagnosis and Research; High-Speed Motion-Picture Photography of Electrical Arcs on a High-Voltage Power System; Applications of High-Speed Photography in Rocket Motor Research; Use of Photography in the Underground Explosion Test Program, 1951-1952; High-Speed Photographic Techniques for the Study of the Welding Arc. GENERAL SURVEYS. Photography of Motion; History and Present Position of High-Speed Photography in Great Britain; Bibliography on High-Speed Photography (Including Schlieren and Cathode-Ray Oscillograph Photography); The Development of High-Speed Photography in Europe; High-Speed Photography in the Chemical Industry; DATA PERTAINING TO HIGH-SPEED PHOTOGRAPHY. The Economics of High-Speed Photography; Practical Aspects of Reciprocity-Law Failure; Accuracy Limitations on High-Speed Metric Photography; Random Picture Spacing with Multiple Camera Installations; Growth and Decay of Light Measured Photographically from Flash-Discharge Tubes; Cumulative Index, p. 354.

High-Speed Photography. Volume 6. Foreword by Richard O. Painter. New York: Society of Motion Picture and Television Engineers, 1957. 200pp. illus.

Contents: Foreword; Multipurpose Optical Tracking and Instrument; Duo-Flash Photography; Requirements for Cameras in Guided Missiles; High-Repetition Rate Stroboscopic Light Source; A 16mm Projector for Research Films; Simple Electronic Timing Device for High-Speed Cinematography; Simultaneous High-Speed Framing and Streak Recording in 16mm; A Rugged and Efficient High-Speed Photographic Illumination System; Illumination Control for a Direction-Indicating System for the M-45 Tracking Camera Mount; A High-Intensity Electronic Light Source for High-Speed Cameras; Improved 16mm Projector for Research Films; Techniques for Effective High-Speed Photography and Analysis; Multiple-Image Silhouette Photography for the NOTS Aeroballistics Laboratory; Use of Photography in Ballistic Measurements; Motion Picture Photography in Guided-Missile Research; Photographic Instrumentation at Project SMART; Third International Congress and Other

High-Speed Photography Activities; A Color Schlieren System for High-Speed Photography; Some New Aspects of Photogrammetric Equipment; Duration and Peak Candlepower of Some Electronic Flashlamps; Electronic Flashlamps; Processing Anscochrome Motion-Picture Films for Industrial and Scientific Applications; Acceleration Accuracy: Analyses of High-Speed Camera Film; Modifications of Military Photographic Equipment; Several Films for Use in High-Speed Motion-Picture Photography; High-Speed Explosive Argon-Flash Photography System; Some Practical Considerations in the Analysis of High-Speed Motion Picture Data; Cumulative Index of Authors and Titles.

Hyzer, William G. Engineering and Scientific High-Speed Photography. New York: The Macmillan Co., 1962. 536pp. illus.

From the Preface: It is a book intended to provide a solid foundation in high-speed photographic measurements for three groups of readers: the engineer or scientist embarking on the use of photography as an instrument of measurement, the well-qualified industrial photographer who requires special guidance in the application of photography to scientific problems, and the photo instrumentation engineer who should find it useful as a general handbook in his field....

In order to be both meaningful and useful to the nontechnical reader, the equations are made simple and straightforward. The portions dealing with photographic principles and practices are presented in comprehensible form, while numerous step-by-step instructions, illustrations, curves, tables, and nomographs make the book a useful reference tool. It is therefore a practical book for those who want to make better high-speed photographs and analysis, taking the reader on occasional side-trips into time-lapse and other related fields of scientific photography.

Contents: Chapter I. Introduction to PhotoInstrumentation; 2. Data-Recording Cameras: Low Speed; 3. Data-Recording Cameras: High-Speed; 4. Photographic Optics; 5. Photosensitive Materials; 6. Lighting and Exposure; 7. Techniques in High-Speed Photography; 8. Oscillography; 9. Specialized Applications; 10. Film Analystical Techniques. Bibliography, p. 521. Index, p. 523.

________. Optimum Techniques of High Speed Film Making: A Basic Course in High Speed Cinematography. Part I., Lessons I-IV. Janesville, Wisconsin: PhotoData Institute, 1975.

Table of Contents: Lesson I. Introduction I-1 -- I-18. High Speed Photographic Instruments, Film Transport Cameras, Intermittent Cameras, Rotating Prism Cameras, Why Isn't it Applied, Is it Difficult, Basic Concepts, What to Specify in a

Camera, Hycam Optical Schematics, Table of Frame Capacities, Table of Film Lengths, Questions.

Lesson II. How to Get Started II-1--II-12. Is it Worth It? Paper and Pencil Estimates, Lets Take an Example, Break-Even Point, Fixed Costs, Variable Costs, Comparing Costs, Problems.

Lesson III. Fundamentals of Camera Operation III-1--III-23. Camera Speeds, Practical Running Speed, Picture Frequency Required to Record Extremely Brief Actions, Lens Diaphram Settings, Reciprocity Effect, Color of Subject, Typical Exposure, Keeping Exposure Data, Duration of Run, Lighting, Recommended Artificial Lighting, Angle of Light, Light to Subject Distance, Suggestions on Lighting, Problems, Camera Acceleration Curves, Table of Symbols, Cosin Functions, Calibration of Honeywell Brightness Meter.

Lesson IV. Compilation of Photographic Parameters Part I. IV-1 -- IV-14. Defining the High Speed Problem, Estimating Conditions of Photography, Nomenclature, Image Magnification and Reduction, Minimum Resolution Element, Image Blur, Depth of Field, Brightness, Guide-Number Nomograph, Table of Event Parameters. Part 2. IV-15 -- IV-19. Computational Methods. Part 3. IV-20 -- IV-36. High-Speed Camera Data Sheet. Problems for Part I, 2,3. Work Sheets. Nomemclature. Bibliography, p. IV-36.

______. Photographic Instrumentation Science and Engineering. Its Military Equipments, Techniques and Applications. October, 1965. Prepared under Navy Contract #NOw63-0524f for Naval Air Systems Command. Published by direction of the Departments of the Army, Navy and the Air Force. Washington, D.C.: Superintendent of Documents, U.S. Government Printing Office. 1965 [1967]. x + [682pp].

A report on specialized instruments, techniques and applications in the field of photographic instrumentation. Military projects utilizing the photographic medium to detect, record and measure phenomena of a scientific or engineering nature were the principal subjects of this survey.

A broad spectrum of projects. . . to cover the field in breadth--not in depth--with the primary objective of compiling novel techniques, new types of instruments, modifications to existing instruments, and new applications of interest to workers in the field. . . .

Chapter I.0. General Considerations. 1.1. Introduction to the Field, 1.2. History. 1.3. Basic Definitions and Scope. 1.4. Problems and Trends. 1.5. Education. 1.6. Functional Organization. 2.0. Photographic Recording Instruments. 3.0. Optical Component Systems. 4.0. Photosensitive Materials and Processes. 5.0. Illuminants. 6.0. Mechanical and Electronic Component Systems. 7.0. Data Processing. 8.0. Specialized Techniques and Devices. 8.1. General Considerations.

8.2. Shadowgraph Techniques. 8.3. Schlieren Techniques. 8.4. Interferometry. 8.5. Scope Recording. 8.6. Radiography. 8.7. Nuclear Emulsions. 8.8. Underwater. 8.9. Cinetheodolites. 8.10. Synchro-Ballistic Techniques. 8.11. Telescopy. 8.12. Topographic Measurements. 8.13. Television. 8.14. Time-Resolution Spectroscopy. 9.0.: 9.1. General Considerations. 9.2. Mechanical Analysis. 9.3. Data-Panel Recording. 9.4. Detonation and Explosive Studies. 9.5. Ballistic Studies. 9.6. Atmospheric Studies. 9.7. Sled Track Recording. 9.8. Flame and Combustion Analysis. 9.9. Motor Vehicle Testing. 9.10. Liquid Flow Studies. 9.11. Gas and Flow Studies. 9.12. Photography of Living Subjects. 9.13. Stress, Shock, and Vibration. 9.14. Spacecraft Instrumentation.

Instrumentation and High-Speed Photography. Volume 1., Series II. Foreword by Carlos Elmer. New York: Society of Motion Picture and Television Engineers, 1960. 187pp. illus.

A selection of papers previously printed in the Journal of the SMPTE. Contents includes materials on the following areas: Light Sources; Optics and Visibility Studies; Cameras and Accessories; Cathode Ray Tubes--Properties and Uses; Television Systems in Instrumentation; Very High-Speed Systems; Processing and Processing Machines; Applications in Military and Industrial Test Programs.

Also includes Progress Reports [Extracts]; Abstracts in French; Abstracts in German; Cumulative Lists of Contents, Vols. 1-6 (Series I), and Vol. 1 (Series II).

Instrumentation and High-Speed Photography. Volume II., Series II. Foreword by Max Beard. New York: Society of Motion Picture and Television Engineers, 1963. 200pp. illus.

A selection of papers previously printed in the Journal of the SMPTE. Does not include papers which appeared in the Proceedings of the Fifth International Congress on High-Speed Photography, sponsored by the SMPTE in 1960.

Earlier volumes dealt with high-speed photography, this volume includes the broader aspects of photographic instrumentation such as space technology and its new environmental problems, and the broader uses of non-silver photosensitive types of recording media for instrumentation systems.

International Congress on High-Speed Photography. 1st. [Symposium at the 72nd SMPTE Conference, October, 1952 Washington, D.C.]. See High-Speed Photography, Volume 5. SMPTE Reprint, Edited by John H. Waddell. New York: Society of Motion Picture and Television Engineers, 1954. 359pp. illus.

International Congress on High-Speed Photography. 2nd. Proceedings. ["Actes du 2eme congres international de photographie et cinematographie ultra-rapides, Paris, September, 1954"]. Edited by P. Naslin and J. Vivie. Paris: Dunod, 1956. xxviii, + 455pp. illus.

Part 1. Flash Lamps and Flash Cameras; 2. Radiography; 3. High-Speed Shutters; 4. Mechanical Optical Cameras; 5. Image Dissection Cameras; 6. Sensitive Surfaces; 7. Lighting; 8. Applications in Various Fields; 9. Ballistics; 10. Shock Failure Process; 11. Schlieren and Interferometry; 12. Biology; 13. Metallurgy and Mechanical Engineering; 14. Atomization. [Many papers include extensive references and bibliography].

International Congress on High-Speed Photography. 3rd. Proceedings. [September 10 - 15, 1956. London, England]. Edited by R. B. Collins. London: Butterworths Science Publications, Ltd., 1957. 417pp.

International Congress on High-Speed Photography. 4th. Proceedings. [September 22 - 27, 1958, Cologne]. ("Kurzzeitphotographie bericht über den IV internationalen kongress für kurzzeitphotographie und hochfrequenzkinematographie, Köln, 22.-27. September 1958. Herausgegeben von H. Schardin und O. Helwich"). Darmstadt: Verlag Dr. Othmer Helwich, 1959. 340pp. illus.

International Congress on High-Speed Photography. 5th. Proceedings. [October 16-22, 1960, Washington, D.C., USA]. Edited by J.S. Courtney-Pratt, Foreword by J.S. Courtney-Pratt. New York: Society of Motion Picture and Television Engineers, 1962. xx + 584pp. illus.

The Fifth International Congress on High-Speed Photography was sponsored by the SMPTE and supported in part by the Departments of the Army, Navy and the Air Force at Washington, D.C., U.S.A., on October 16-22, 1960. Chairman: Max Beard, U.S. Naval Ordnance Laboratory, Silver Spring, Maryland.

Proceedings: Section A. Flashlamp Sources, p. 3; B. Photographic Materials and Optical Components, p. 63; C. Electronic Shutters, p. 95; D. Flash X-Ray, p. 149; E. Unusual Techniques, p. 197; F. Stereo, Spectra and Micro-Studies, p. 265; G. Streak Cameras, p. 297; H. Multiple Frame Cameras, p. 329; I. Applications--Ballistics, p. 369; J. Applications--Industry and Biology, p. 393; K. Values and Problems in High Speed Photography, p. 411; L. Survey Papers, p. 441; M. Systems for Control and Analysis; N. Flow Dynamics, p. 489.

Papers are printed in English with abstracts in French and German. Discussions were in many cases condensed due to space. Questions and answers were also omitted where the subject matter is expertly covered in the relevant papers. Late contributions

were omitted unles they had a direct bearing and new viewpoint on a subject already included. Contributions not directly related to the field of high-speed photography were omitted.

A number of papers describing technical and scientific characteristics of equipment commercially available were also omitted. A number of papers [40 papers] chosen from the various branches of high-speed photography have appeared in the SMPTE Journal and in Photographic Science and Engineering.

International Congress on High-Speed Photography. 6th. Proceedings. [September 17-22, 1962, The Hague/ Scheveningen, the Netherlands]. Edited by J.G.A. DeGraff and P. Tegelaar. Haarlem, the Netherlands: H.D. Tjeenk Willink & Zoon N.V., 1963. 771pp. illus

The order of the papers published in this volume is the same in which they were presented during the congress. Several Russian papers not read at the congress have been included in an attempt to promote contacts with Russian high-speed specialists. Compilation of papers published in the language presented. Summaries are given in English, French and German.

Contents: Opening Session, xvii; Session 1. General Lecture: 1-A. H. Schardin (Deutschland). Über die grenzen der hochfrequenzkinematographie. p. 1; Session II and III. Cameras; Session IV. Cameras and Light Sources; Session V. Light Sources; VI. Flash X-Ray; VII. Applications; VIII Misc.; IX. Cameras and Shutters; X. Kerr-Cells and Intensifiers; XI. Kerr-Cells and Sensitive Materials; XII. Instrument Aids; XIII. Shock Waves; XIV. Explosives; XV. Applications; XVI. Applications; XVII, and XVIII. Miscellaneous. Summaries, p. 629. Resumes, p. 673; Zusammenfassungen, 720. Index. p. 770.

International Congress on High-Speed Photography. 7th. Proceedings. [September 12-18, 1965, Zurich, Switzerland] Edited by Othmar Helwich. ("Kurzzeitphotographie bericht über den VII internationaler kongress für kurzzeitphotographie und hochfrequenzkinematographie, Zürich, 12.-18. September 1965. Herausgegeben von O. Helwich"). Darmstadt: Verlag Dr. Othmar Helwich, Darmstadt und Wien, 1967. 607pp. illus.

This volume contains the 98 papers presented at the Zurich Congress by 160 authors and co-authors from 11 countries.

International Congress on High-Speed Photography. 8th. Proceedings. [June 23-28, 1968, Stockholm, Sweden]. Edited by N.R. Nilsson and L. Högberg. New York: John Wiley and Sons., Inc., 1968. 515pp. illus.

The 8th International Congress on High-Speed Photography, held in Stockholm, Sweden on June 23-28, 1968 was organized by the Royal Swedish Academy of Engineering Sciences in cooperation

with the Research Institute of National Swedish Defense. The Congress gathered some 480 participants from 22 countries and more than 125 lectures were delivered; 24 companies and organizations from 8 countries took part in the commercial exhibits.

Table of Contents: Opening Ceremony. Opening Speech. E. Ingelstam, President of the Congress. Address of Welcome O. Palme, Minister of Education. Address of Welcome M. Fehrm. Director General The Research Institute of National Swedish Defense. Main headings including papers and lectures presented on the following topics: Image Converters and Electronic Shutters; Mechanical Shutters; Fiber Optics; Streak Cameras; Framing Cameras; Image Dissection Cameras; Time Resolved Spectroscopy; Flash Light Sources; X-Ray Flash Systems; Lasers; Holography; Schlieren Techniques; Interferometric Techniques; Terminology; Photographic Techniques; Applications; Systems for Analysis; Photographic Materials; Survey Papers. List of Publications by Hubert Schardin (1929-1965), p. 497. Author Index, p. 501.

International Congress on High-Speed Photography. 9th. Proceedings. [August, 1970, Denver, Colorado, United States of America]. Edited by W.G. Hyzer and W.G. Chase. New York: Society of Motion Picture and Television Engineers, 1970. 605pp. illus.

These Proceedings of the Congress comprise all papers presented, pertinent discussions generated and a current bibliography on the subject of High-Speed Photography.

Contents: xiii Editors' Foreword. xiv Joint Resolution of the U.S. Congress. xv Committee of Honor and National Delegates. xvi Organization. 1. Report on the Seminar on Educational Requirements and Programs in High-Speed Photography, Photographic Instrumentation, and Photographic Science, George H. Lunn and Herbert E. Farmer.

Main Selections include: Holography and Image Dissection Cameras; Lasers; Rotating-Mirror and Streak Cameras; Image Converters; Light Sources and X-Ray; Applications; Technical Films. Current Bibliography on High-Speed Photography 1964-1970. Compiled by Elizabeth W. Kraus and Edited by William F. Walker, p. 548. Report on the Congress by Carlos H. Elmer, p. 597; List of Delegates and Discussers, p. 599; Index of Authors and Discussers, p. 604.

International Congress on High-Speed Photography. 10th. Proceedings. [September 25-30, Nice, France, 1972]. ("Congres international de cinematographie ultra-rapide, 10th Nice, France, September 25-30, 1972, Actes"). Conference sponsored by the Ministere du Developpement Industrial et Scientifique and Delegation Ministerielle pour l'Armament Paris, Association Nationale de la Recherche Technique 1973. 523pp. illus. In French, English and German.

Mechano-optical electronic and picosecond cameras are described and the acquisition, metrology and the processing of images are discussed. A number of papers deal with aspects of holography, interferometry, temporal resolution, spectrography, stereoscopy and miscellaneous subjects. Pulsed Light Sources, Lasers, other sources, and propagation in fluids are treated. Materials and the explosive techniques are also examined.

International Congress on High-Speed Photography. 11th. Proceedings. High Speed Photography. [September, 1974, Imperial College, University of London]. Edited by P.J. Rolls (Royal Aircraft Establishment, Farnborough). Distributed in the United States of America by the Society of Photo-Optical Instrumentation Engineers. London: Chapman and Hall Ltd., 1975. 651pp. illus.

Technical program offered a wide range of subjects including high-speed physical processes and techniques in which optical and electro-optical recording processes, as well as photography play an important part. The applications covered the observation of shock waves and high-speed gasdynamics, explosions and combustion processes, fast chemical reactions, impact and fracture phenomena in materials, electrical discharges and high-speed mechanisms.

Invited papers included: Paper I. Picosecond Pusle Measurement and its Scientific Applications, D. J. Bradley; Paper II. Picosecond Image Converter Diagnostics, M. Ya. Schelev; Paper III. New Laser High-Speed Measurement Techniques in Aerodynamics, R. Schall [In German]; Paper IV. A Review of the Current State of the Art, J. Hadland.

Session A1. High-Speed and Ultra High-Speed Cameras. Session A2-A3. Electro-Optical Cameras and Shutters. Session A4. Electro-Optical Cameras and Shutters. Session B9 and B10. Electro-Optical Cameras; Sessions A5,A6 and A7. Holography and Interferometry; Session B11. Holography and Analysis; Session A8. Laser and Plasma Sources; A11. Continuous, Flash and X-Ray Sources; A9 and A10. Schlieren, Shadowgraphy, Microscopy, Steroescopy [sic] and Time Resolved Spectroscopy. A12. Data Reduction and Image Analysis; A13, 14, 15, 16, and B12. Applications; B13 and B14. Late Papers; B4 and B5. Terminology. Papers Supplied by Authors but not presented at the Congress, p. 596. Author Index, p. 635. Subject Index, p. 638.

International Congress on High-Speed Photography (Photonics). 12th. Proceedings. [Scheduled for August 1-7, 1976, Toronto, Canada]. President Dr. W.G. Schneider (President National Research Council of Canade; Chairman Dr. Martin Richardson, National Research Council of Canada. Proceedings to be published in book form--will probably be available early in 1977.

From the preliminary announcement. Technical Programme: The range of subjects is very wide and includes the complete spectrum of high-speed physical processes and techniques in which optical and electro-optical recording processes, as well as photography play a part. The applications cover observation of shock waves and high-speed gasdynamics, explosions and combustion processes, fast chemical reactions, impact and fracture phenomena in materials, electrical discharges and high-speed mechanisms.

Jones, George A. High Speed Photography: Its Principles and Applications. New York: John Wiley & Sons, Inc., 1952. 311pp. illus.

The author attempts to summarize the basic fundamentals of current procedures [1952] and the scope of various aspects of high-speed photography. Extensive bibliographic information is given for those requiring materials for further study and research.

Contents: 1. Introduction and History. II. The Products of Short Flashes. III. High Speed Cinematograph Camera Design. IV. Photography Materials. V. High Speed Still Photography. VI. High Speed Cinematograph Cameras. VII. Cinematographic Technique. VIII. Trace Recording Cameras. IX. Picture-Making Recording Cameras. X. Scientific Applications of High Speed Photography. XI. Industrial and Commercial Applications.

Appendix A. High Speed Cameras. B. Gas-Discharge Flash Tubes. C. Formulae. Index of Names. General Index.

Kirillov, N. I. Problems in Photographic Research and Technology. A translation of Problemy fotografii ("Problems of Photography"). Moscow: Izd-vo, "Iskusstvo," 1965. Translated by Intercontinental Translators, London, Edited by F. A. Sutherns. London and New York: The Focal Press Ltd., 1967. 208pp.

The author devotes the first chapter to the question of photographic sensitivity in both general scientific and technical aspects. The process of developing, in particular, the function and influence of the constituents of developers, their formulae and the different conditions of developing is reviewed in the second chapter. The third chapter deals with the rapid and ultra-rapid processing of photographic layers, in addition to the process of simultaneous developing and fixing and the process of light sensitive materials containing developer substances.

The fourth and last chapter, takes into consideration continuous processes for the synthesis of photographic emulsions, the possibilities of creating automatic technological lines for the routine mass printing of black-and-white films, and various developing equipment and arrangements used in the rapid and ultra-rapid processing of light sensitive materials.

Lavrent'yev, V. I., and Pell', V. G. Skorostnaya kinos"yemka kameroi SKS-1. ("High-Speed Motion Picture Photography Camera SKS-1"). Moscow: Izd-vo, "Iskusstvo," 1963. 221pp. illus.

Miller, Charles E. Handbook of High-Speed Photography. 2nd. ed., Revised. Foreword by Harold E. Edgerton, West Concord, Mass.: General Radio Co., 1967. iv + 92pp. illus.

Contents: Acknowledgements; Foreword; Section 1. Introduction. 1.1. Stopping Action with a Short Expousre Time. 1.2. Multiple-Exposure Motion Studies with a Strobotac Meter. 1.3. Using the Stroboscope with Moving Film. Section 2. Characteristics of Stroboscopes; Section 3. General Radio Stroboscopes; Section 4. Still Photography; Section 5. Synchronization; Section 6. Motion Picture Photography. Photographs, p. 66; Bibliography, p. 81. Index, p. 84. Catalog Section, p. 86.

Nilsson, N. R., and Högberg, Lars., eds. High-Speed Photography. New York: John Wiley & Sons, Inc., 1968. 515pp. [See International Congress on High-Speed Photography. 8th. Proceedings. (p. 21)].

Salamandra, Genrietta D. Fotograficheskiye metody issledovaniya bystroprotekayushchikh protsessov. ("Photographic Methods for Studying High-Speed Processes"). Chief Editor V. P. Motulevich. Moscow: Izd-vo, "Nauka," 1974. 200pp.

________., et al. Nikotoryye metody issledovaniya bystroprotekayushchikh protsessov i ikh primeneniye k izucheniyu formirovaniya detonatsionnoy volny. ("Certain Methods of Studying High-Speed Processes and their Application to the Study of the Formation of a Detonation Wave"). Moscow: Izd-vo, "AN SSSR" ("Academy of Sciences of the U.S.S.R."), 1960. pp. 5-57 [An English Language Translation--November 2, 1961; Available as Accession No. AD 267 705 from NTIS, Springflield, Va. 89pp.

The following material has been translated. Chapter 1. High-Speed Photography. Section 1. Spark Discharge. Section 2. Obtaining a Sequence of Sparks. Section 3. Synchronization Circuits for Spark Photography. Section 4. Photorecorders. Section 5. Spark Devices. Section 6. Pulse Light Sources. Section 7. Spark Photography by Schlieren Methods--The Shadowgraph Method. The Töpler Method, Interference Method, Combination Methods of Photography. Conclusion.

Chapter 2. Procedure for Measuring Varialbe Pressures Containing Gas Dynamic Discontinuities. Section 1. The Design and Method of Manufacture of a Pulse Piezoelectric Pressure Sensor. Section 2. Analysis of the Operation of a Piezoelectric Pressure Sensor. Section 3. The Recording of a Piezoelectric Signal. Section 4. Methods of Calibrating a Pressure Sensor.

Saxe, R. F. High Speed Photography. London: The Focal Press, Ltd., 1966. 137pp. illus.

A review of contemporary practices and applications of high-speed photography. The author treats the following subjects in various chapters. The author noted that "in this volume, an attempt has been made to present the basic considerations governing the possibilities and limitations of given techniques, so that the reader who is unfamiliar with the field may appreciate the difficulties liable to be encountered, and may have some means of assessing how nearly the limits of various techniques have been approached. It is not possible in a volume of this size to deal exhaustively with each method from fundamental principles, but representative methods have been described."

Contents: Chapter 1. Introduction; 2. High-Speed Cameras; 3. Rotating Mirror Cameras; 4. Short-Exposure Single-Picture Devices; 5. Light Sources; 6. Image Dissection and Similar Techniques; 7. Techniques for the Study of Fluid Behaviour; 8. Flash X-Rays; 9. Electronic Techniques; 10. Film Analysis; References; Index.

Shaftan, Kenneth, and Hawley, Dean [Deceased]. Photographic Instrumentation; Techniques--Equipments--Applications. Redondo Beach, Calif.: Society of Photographic Instrumentation Engineers [now Society of Photo-Optical Instrumentation Engineers], 1962. xlviii + 336pp. illus.

Contents: Chapter 1. Introduction; 2. General Considerations. 2.1. The Qualitative Uses of Photographic Instrumentation. 2.2. The Quantitative Uses of Photographic Instrumentation. 2.3. Components of Photographic Instrumentation. 2.4. Limitations of Photographic Equipment. 2.5. Facility in Photographic Instrumentation. 3. Techniques in Photographic Instrumentation. 3.1. Introduction. 3.2. Still Photography. 3.3. Motion Picture Photography. 3.4. Streak Photography. 3.5. Shadowgraph Photography. 3.6. Schlieren Photography. 3.7. Interferometric Photography. 3.8. Comparison Between Shadowgraph, Schlieren and Interferometric Photography. 3.9. Radiography-General. 3.10. Photomicrography. 3.11. Three-Dimensional Photography. 3.12. Data Recording Photography--General Comments. 3.13. Fluid Mechanics Photography--(Liquid). 3.14. Fluid Mechanics Photography--(Gases). 3.15. Illumination Techniques. 3.16. Timing. 3.17. Reduction of Data. 4. Equipment for Photographic Instrumentation. 4.1. General Considerations. 4.2. Still Photographic Equipment. 4.3. Motion Picture Camera Equipment. 4.4. Streak Camera Equipment. 4.5. X-Ray Equipment. 4.6. Shadowgraph Equipment. 4.7. Schlieren Equipment. 4.8. Interferometric Equipment. 4.9. Photomicrographic Equipment. 4.10. Recording Materials--Photo Sensitive. 4.11. Recording Materials--Non-Photo Sensitive. 4.12. Special Photographic

Processing. 4.13. Illuminants--Continuous. 4..4. Illuminants--Transient Single Flash. 4.15. Illuminants--Transient Repetitive Flash. 4.16. Illuminants--Spectral Requirements. 4.17. Illuminants--Special Requirements. 4.18. Apparatus for Transient Illumination. 4.19. Electronic and Electrical Circuitry. 4.20. Optical Components. 4.21. Data Analysis Equipment. 5. Applications of Photographic Instrumentation. Bibliography [440 References]. 7. Appendices. 7.1. Illuminants -Continuous. 7.2. High-Speed, Very High-Speed, and Ultra High-Speed Motion Picture Cameras. 7.3. Hydrogen Thyratron Characteristics. Addenda, pp. 327-336, for additional notes by the reader.

State Committee of the Council of Ministers for Cinematography; Leningrad Institute of Cinema Engineers; Union of Cinema Workers of the U.S.S.R., Leningrad Department, Section of Science and Technology. Materialy nauchnoy konferentsii prepodavateley. ("Materials of the Scientific Conference for Educators"). Leningrad: 1975. 175pp. illus.

A compilation of materials to include selections on photography and motion picture materials; optical systems for photography and cinematography; motion picture photographic equipment; applications of photography and cinematography in science and engineering. Also includes material by the author N.A. Dranovskiy, "Contemporary State of the Technology of High-Speed Motion Picture Photographic Equipment," pp. 119-120. A short classification of equipment applicable for high-speed photography and cinematography produced in the U.S.S.R., and in foreign countries. Reviews conditions which are necessary for the implementation and provision of required apparatus for high-speed motion picture photography.

Waddell, John H. High Speed Photography. New York: Bell Telephone Laboratories, 1947. illus.

Small edition printed for classes given by the author--Elaborates on rotating prism cameras; Early history is covered in illustrations.

_______. Rotating Prism Design for Continuous Image Compensation Cameras. [Douglas Paper 3042] Santa Monica, Calif.: Douglas Missile and Space Systems Division, 1964. 53pp.

Abstract: The rotating prisms used in high-speed motion picture cameras have been designed empirically since their first use thirty-two years ago. During that period, there have been advances made in glass technology and fabrication which have resulted in the production of better images. This paper summarizes the latest state-fo-the art wherein it will be domstrated that prism design should not be confined to the "D" line of the Spectrum, but expanded to cover the ultraviolet and infra-red portsions of the spectrum.

The prism design shall cover: 1. Selection of the average angle of incidence for exposure. 2. The choice of glass or other transparent media. 3. The corrleationship between image and film velocity. 4. Discussion of the inherent aberrations; namely, a. non-linear distortion; b. Sagittal and Tangential Coma; c. Prismatic Astigmatism; d. Change in backfocus due to prism rotation; 5. Shuttering Action; 6. Aperture Design.

There have been only fragmentary data published on the subject to date. It is necessary to secure this thirty years experience before this datum is forever lost. Recommendation for future action is made including computer studies for optimization of designs.

_______., and Smith, H.J. History of the Rotating Prism Camera. [A Douglas Paper]. Santa Monica, Ca.: Douglas Missile and Space Systems Division. 27pp. [Attached Curves].

History and background of rotating prism camera development.

_______., and Waddell, Jennie W. Photographic Motion Analysis. [Preface by Harold E. Edgerton, Massachusetts Institute of Technology--MIT, January 26, 1955]. Chicago, Ill.: Industrial Laboratories Publishing Co., 1955. 87pp. illus.

Table of Contents: Preface, i; Authors' Foreword, ii. Chapter 1. Introduction, Velocity of Subject, Resolution of Data to be Transcribed, Working Distance, History, Rotating Prism Cameras are Born, High Voltage Discharge Tube. II. Development of High-Speed Motion Picture Cameras Employing Optical Compensation. Rotating Prism Cameras. Single Drive Motor. Critical Roller Adjustment. III. Light Sources. Sunlight, Incandescent Tungsten Sources, Gas Discharge Sources, other Electrical Discharge Sources. Photoflash Lamps, Methods of Illumination. Transmitted Light. Measurement of Light Sources. IV. Sensitized Materials in Measurement Photography. Film Speeds. Stereoscopic Photography. V. Measurement and Optics. Long Focal Length Lenses for Tracking. Wide Angle Lenses, View Finders. VI. Fiducial Markers. Concave Mirror Measurements. Reflection. Effects of Introducing Parallel Plate Prisms. Ballistic Military Photography, Missiles in Flight. VII. Missiles in Flight (Continued), Detonation, Explosion and Impact Studies. Shadowgraph Photography. VII. Underwater Photography. Oscillograph and Streak Recording, High-Speed Photography and Aircraft, Time Lapse Photography, Astronomical Motion Photography. IX. Medical Motion Photography, Biological Studies, Gears and Sprockets, Transporation Studies, Packaging, Materials Testing, Motion in the Machine Shop. X. Flow of Solids, Liquids and Gases, Wires, Filaments and Threads, High-Speed Photography of Relays, Arc and Gas Welding, Analysis of Photographic Records, Motion Photography in Instructional Films. Conclusion, p. 84. Addenda and Errata, p. 85. Index, p. 87.

CHAPTER III

HOLOGRAPHY AND LASERS

PRINCIPLES AND APPLICATIONS

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HOLOGRAPHY AND LASERS

PRINCIPLES AND APPLICATIONS

Arecchi, F. T., and Schulz-Dubois, E. O., eds. Laser Handbook. In Two Volumes. Amsterdam: North-Holland Publishing Co.

Vol. 1 1973. xxii + 1028pp. illus. Contents: Part A. Basic Theory and Laser Physics; Part B. Classes of Lasers; Part C. Laser Devices and Techniques; Part D. Materials for Nonlinear Optics. Vol. II. 1973. x + 919pp. illus. Contents: Part E. Physical Applications; Part F. Technical Applications.

Brotherton, M. Masers and Lasers. How They Work, What They Do. Foreword by C.H. Townes. New York: McGraw-Hill Book Co., Inc., 207pp.

Explains key ideas and principles behind masers and lasers; Discusses the origin, significance and the role played by these electronic devices in science and technology today. Also discusses various aspects of masers and lasers in relation to physical science, electronics and communications.

Butters, John N. Holography and its Technology. London: Peter Pergrinus, 1971. viii + 288pp. illus.

The historical and theoretical fundamentals of holography; Arrangements for holography set-up; Photomaterials utilized in holography; Their treatment and other problems of practical applications of holography.

Cathey, W. Thomas. Optical Information Processing and Holography. New York: John Wiley and Sons, Inc., 1974. 398pp. illus.

General treatment of holography, scalar diffraction, coherence theory, optical information processing and pattern recognition. Applications are dealt with in Chapter 10.

Collier, Robert J., et al. Optical Holography. New York: Academic Press, Inc., 1971. 618pp. illus.

A monograph on the theory and art of forming holograms with visible light--begins with basics and optical concepts, provides a step-by-step analysis of the holographic method--prescribes tools and techniques necessary for making good holograms.

Develis, John B., and Reynolds, George O. Theory and Applications of Holography. Reading, Mass.: Addison-Wesley Publishing Co., Inc., 1967. 196pp. illus.

Dreiden, G.V., and Shedova, E.N. "Rezonansnaia golografiia" ("Resonance Holography"), in Opticheskaia golografiia. ("Optical Holography"). Leningrad: Izd-vo, "Nauka," 1975. pp. 71-114. 32 refs.

Holographic interferometry for the measurement of the spatial density distribution of heavy particles with a definite atomic state in nonuniform media, such as shock waves, flames, gas flows, and plasmas.

Farhat, Nabil H., ed. Advances in Holography. Vol. 1 [Acoustical Holography; Survey by R.K. Mueller]. New York: Marcel Dekker, Inc., 1975. 192pp. illus.

______. Advances in Holography. Vol. 2 New York: Marcel Dekker Inc., 1976. 191pp. illus.

I. Microwave analogs of holography, pulse compression, new optimal processes, range-Doppler radar for rotating bodies and phased array beam forming. II. Reviews recyclable incoherent-to coherent image converters. III. Holographic spectroscopy is examined and its advantages discussed.

Ginzburg, Vera M., and Stepanov, Boris M., eds. Golografiya: Metody i apparatura. ("Holography: Methods and Apparatus") Moscow: Izd-vo, "Sovetskoye radio," 1974. 376pp. illus.

Holography in Measuring Technology; Optical Holography; Properties of Ultra High Frequency Holography; Holographic Systems of Ultra High Frequency Range; Measuring of Geometric Parameters of Objects by Holographic Images; Numerical Holography; Methods of Analyzing Holographic Interferrograms; Holography Apparatus; Application of Optical Holography in Investigation of Stationary Objects and Slow Processes;-- and of Dynamic Objects and Rapid Processes. Appendices. Biblio.

Goldman, Leon. Applications of the Laser. Cleveland, Ohio: CRC Press, Inc., 1973. 320pp. illus.

Chapter 19. Laser Photography; Laser Microphotography; Art Photography; High-Speed Photography; Safety Program for Laser Photography and Kirlian Electro-Photography, etc.

Harry, John E. Industrial Lasers and Their Applications. New York: McGraw-Hill Book Co., 1974. 189pp.

Hildebrand, B.P., and Brenden, B.B. An Introduction to Acoustical Holography. New York: Plenum Press, Inc., 1974. 224pp.

Holographic Instrumentation Applications. [Conference at Ames Research Center, Moffett Field, Ca., Jan 13-14, 1970]. edited by Boris Ragent and Richard M. Brown. NASA No. SP248. Washington, D.C.: NASA, 1970. 241pp. illus.

International Symposium on Acoustical Holography. 1st. Proceedings. [December, 1967]. Vol. 1. Acoustical Holography. Edited by A.F. Metherell, et al. New York: Plenum Press, Inc., 1968. 330pp. illus.

______. 2nd. Proceedings. [March, 1969]. Vol. 2. Acoustical Holography. Edited by A.F. Metherell and Lewis Larmore. New York: Plenum Press, Inc., 1970. xv+376pp. illus.

Several papers deal with the detection problem and include a discussion of liquid-crystal detectors, improvement of the Sokolov acoustic-image converter tube, transducer arrays, optical scanning of the acoustic field, and the detection using a thin liquid layer. Techniques discussed include phase-only recording, temporal-reference acoustical holography, digital probessing of the hologram information, and color acoustical holography.

______. 3rd. Proceedings. [July, 1970]. Vol. 3. Acoustical Holography. Edited by A.F. Metherell. New York: Plenum Press, Inc., 1971. 399pp. illus.

______. 4th. Proceedings. [April 10-12,1972]. Vol. 4. Acoustical Holography. Edited by Glen Wade. New York: Plenum Press, Inc., 1972. 740pp. illus.

International Symposium on Acoustical Holography and Imaging. 5th. Proceedings. [July 18-20, 1973]. Vol. 5. Edited by Philip S. Green. New York: Plenum Press, Inc., 1973.

Title changed by adding "Imaging," and contents reflect that emphasis by including non-holographic techniques. Papers include theoretical discussions and exploration of such applications as nondestructive testing, underwater imaging and medical diagnosis, and computer processing of acoustical images.

______. 6th. Proceedings. Vol. 6 Edited by Newell Booth. New York: Plenum Publishing Corp., 1975. 760pp.

Examines current progress in the field of acoustical holography and imaging. Provides survey of latest experimental, theoretical, medical and engineering developments.

Jacobs, Stephen, et al. eds. Laser Applications to Optics and Spectroscopy. Reading, Mass.: Addison-Wesley, 1975. 510pp.

Contents: Tunable semiconductor diode lasers and applications. Dye Lasers. Spin-Flip Light Scattering and Spin-Flip Lasers. Generation of ultraviolet and vacuum ultraviolet radiation. Integrated optics--present and future. Nonlinear effects in optical fibers. Application of photon statistics and photon correlation. Light scattering mode-licked lasers and ultrashort light pulses. Stabilized lasers and applications. Subdoppler spectroscopy, methane hyperfine spectroscopy, and the ultimate resolution limits. Design and operation of a methane absorption stabilized laser strainmeter adiobatic following. Nonlinear spectroscopy. Index.

Kirillov, N.I., and Barachevskii, V.A. Registriruiushchie sredy dlya golografii. ("Recording Media for Holography"). Leningrad: Izd-vo, "Nauka," 1975. 168pp. [In Russian].

Kock, Winston E. Engineering Applications of Lasers and Holography. New York: Plenum Press, 1975. 400pp.

Surveys laser and holography applications. Reviews holographic process and discusses underlying wave concepts, including coherence, diffraction and interference. Examines the nature of holograms with recent developments in laser technology. Describes techniques applied to industry in various fields of measurement, microwaves, acoustics, etc.

_______. Radar, Sonar, and Holography: An Introduction. New York: Academic Press Inc., 1973. 140pp. illus.

Contents: I. Wave Properties; II. Wave Radiators; III. Fundamental Concepts of Echo-Location Systems; IV. Typical Radar and Sonar Systems; V. Doppler and Phased-Array Systems; VI. Holography. Making a Hologram. A Photographic Zone Plate. The Complete Hologram Process. The Hologram of a Scene. Parallax in Holograms. Single-Wavelength Nature of Holograms. Non-Optical Holograms. Microwave Holograms. Acoustic Holograms. Microwave Holograms and Liquid Crystals. Ultrasonic Holograms. Underwater Viewing. Earth Exploration. The Concept of Phase in Holography. VIII. Coherent Radar and Sonar. Epilogue.

Lebedev, D.S., ed. Ikonika. Tsifrovaia golografiia. Obrabotka izobrazhenii. ("Iconics. Digital Holography. Image Processing"). Moscow: Izd-vo, "Nauka," 1975. 151pp.

Reviews digital holography, digital processing of interferograms, anisotropic image filters, TV visual systems for robots, visual tracking of cinematographic images, filtration of unsteady video signals, analysis of the information content of photographic negatives and the synthesis of dynamic images on the television screen.

Mueller, R. K. Advances in Holography. Volume I. New York: Marcell Dekker, Inc., 1975. 180pp. [622 References].

Devoted to a survey of acoustical holography.

Muncheryan, Hrand M. Laser Fundamentals and Applications. Indianapolis: Howard W. Sams, 1975. 192pp. illus.

Okoshi, Takanori. Three-Dimensional Imaging Techniques. New York: Academic Press, Ind., 1976. 366pp.

Chapter 1 is an introduction; Chapter 2 is a short description of the history of three-dimensional imaging techniques; Chapter 3 describes the psysiological and psychological aspects of three-dimensional sensation (depth perception) in humans. Chapters 4-6 describes the theories and applications of three basic techniques; Lens-sheet three-dimensional displays, and

holography; Chap. 7. discusses the quantity and redundancy respectively; Chap. 8. special three-dimensional imaging techniques--for x-ray images and computer outputs as well as the technical feasibility of three-dimensional television in the future are discussed.

Ostrovsky, Yu. I. Golografiya. ("Holography"). Leningrad: "Nauka," Leningrad Branch, 1970. Available as Report No. N-72-23521; NASA TT F-706. Springfield, Va.: NTIS, 1972.

Discusses holography--e.e., the interference-diffraction method of recording and reconstituting wavefronts. The method is being widely applied to optics, radar, acoustics, instrumentation and other uses of science and technology. Along with the exposition of the properties of holograms, their experimental holographic techniques--some of their applications are also described. A popular account of holography.

______. Golografiye i ee primeneniye. ("Holography and its Applications"). Leningrad: Izd-vo, "Nauka," 1973.

Physical principles of holography and its properties. Describes arrangement for obtaining holograms, sources of light and materials for registering the hologram. Reviews Fundamentals.

Perlmutter, Arnold and Widmayer, Susan., eds. Progress in Lasers and Laser Fusion. (Studies in the Natural Sciences V. 8). (Part of the Proceedings of Orbis Scientiae, University of Miami, Center for Theoretical Studies, January 20-24, 1975). Chairman, Behram Kursunoglu. New York: Plenum Press, 1975. vii + 416pp. illus.

Latest developments in laser fusion. Includes: Enhanced Laser Light Absorption; Experiments in Laser Fusion; Magnetic and Inertial Fusion; X-Ray and Chemical Laser; Laser Light Propagation in a Material Medium.

Rosenberger, Dieter., et al. Technische anwendunger das lasers. ("The Technical Applications of Lasers"). Berlin: Springer-Verlag, 1975. 355pp. illus. [In German].

Application: Alignment, Velocimetry, Interferometry,Materials-Working, Optical Information Processing, Optical Communications, Spectroscopy, Chemical Analysis, Photochemistry and Biomedicine.

Ross, Monte., ed. Laser Applications. Vol. 1. New York: Academic Press, Inc., 1971. 320pp. illus.

Applications of Holography; Laser Applications in Metrology and Geodesy; The Laser Gyro; Machine and Building Applications; Laser Communications. Author/Subject Index.

______. Laser Applications. Vol. 2. New York: Academic Press, Inc., 1974. 360pp. illus.

Discusses Laser Scanning Systems, Laser Atmospheric Probing Systems and Integrated Optics.

Saltonstall, Robert Jr. The Commercial Development and Application of Laser Technology; A Report. New York: Hobbs, Dorman & Co., Inc., 1965. 153pp. illus.

Examines most common publicized applications, benefits and potential market a laser system might achieve. Specifies needed developments in laser technology and market feasibility.

Skobel'tsyn, D.V., ed. Physical Processes in Lasers. Trans. by James S. Wood [Proceedings of the P.N. Lebedev Physics Institute, Vol 56]. N.Y.: Consultants Bureau, 1973. 181pp.

Smith, Howard M. Principles of Holography. 2nd ed. New York: John Wiley and Son's, Inc., 1975. 279pp. illus.

Covers major aspects of holography; fundamentals, simple and rigorous theory, techniques, chemical formulas and applications; also includes color holography in terms of plane and volume hologram theories and applies Kogelink's coupled-wave theory to the analysis of thick holograms.

Society of Photo-Optical Instrumentation Engineers. Developments in Holography; Proceedings. Vol. 25 [April 14-15, 1971, Boston, Mass.]. Edited by Brian J. Thompson and John B. DeVelis. Redondo Beach, Calif.: SPIE, 1971.

_______. Developments in Laser Technology. II. Proceedings. [SPIE Seminar-in-Depth, 17th Annual Technical Meeting, San Diego, Calif., August 27-29, 1973]. Edited by Ralph W. Wuerker. Palos Verdes Estates, Calif.: SPIE, 1974. 218pp.

_______. Holography; Proceedings. Vol. 15. [May 23-25, 1968. San Francisco, California]. Edited by Brian J. Thompson. Redondo Beach, Calif.: SPIE, 1968. 193pp.

Stasel'ko, D. I. "Osobennosti golograficheskoi registratsii bystroprotekaiushchikh protsessov pri ispol'zovani impul'snogo lazera na rubine" ("Characteristics of the Holographic Recording of Rapid Processes by Means of Pulsed Ruby Lasers"), in Opticheskaia golografiia. ("Optical Holography"). Leningrad: Izd-vo, "Nauka," 1975. pp4-70. 89 references. (in Russian).

Investigates the holography of rapid processes such as the motion of fast particles.

Steele, Earle L. Optical Lasers in Electronics. New York: John Wiley and Son's, Inc., 1968. 267pp. illus.

An analysis and discussion of selected laser topics; provides analytical and design information on laser devices. The orientation is to examine the optically pumped laser as an oscillator and amplifier. The gas laser is not treated.

Stroke, George W. An Introduction to Coherent Optics and Holography. New York: Academic Press, Inc., 1966. 270pp. illus.

Contents: Introduction; Diffraction Theory (Qualitative Introduction); Image Formation in Non-Coherent Light (Elements and Definitions); Coherence Characteristics of Light (Experimental Characterization); Image Formation in Coherent Light; Theoretical and Experimental Founations of Optical Holography (Wavefront-Reconstruction Imagery); Fourier Transforms, Convolutions, Correlations, Spectral Analysis and the Theory of Distribution. [Reprinted Papers: "A New Microscope Principle," D. Gabor, Nature, 161 No. 4098 (1948), pp. 777-778; "Microscopy by Reconstructed Wave Fronts," D. Gabor, Proceedings of the Royal Society of London, A197 (1949), pp. 454-487; "Microscopy by Reconstructed Wave Fronts," II. D. Gabor. Proceedings of the Royal Society of London, 64, pt. 6 No. 378B (1951), pp. 449-469. Author and Subject Index Included.

Svelto, Orazio. Principles of Lasers. Translated from Italian by David C. Hanna. New York: Plenum Publishing Corp., 1976. 380pp.

Toni, Jorge E.A., et al. Fundamentos de holografia optica. ("Fundamentals of Optical Holography"). Buenes Aires, Argentina: Informaciones Cientificas DIGID No. 180. (April), 1975. 37pp. illus. 62refs. (In Spanish).

Principles of optical holography, including--interference phenomena, diffraction, coherence, visibility, etc.; Theoretical and experimental analysis of the holographic process, its requirements, differences with conventional photography and general properties of holograms.

Vienot, Jean-Charles., et al. Holographie optique--Developpements, Applications. Paris: Dunod, 1971. xiii + 218pp.

Intermediate approach to the study of holography. Treats such subjects as basic imaging equations, effects of the change of wavelength, the fourier-transform description of holography, and geometrical aberrations. Briefly treats color holography; Practical considerations such as motion of objects and film; Various types of holographic interferometry; Non-Mathematical treatment of holograms as complex spatial filters and concludes with miscellaneous subjects such as non-photographic recording kinoforms, and acoustical and microwave photography.

Vodovatov, F. F., et al. Lazery v tekhnologii. ("Lasers for Industrial Applications"). Moscow: Izd-vo, "Energiia," 1975. 216pp. illus. (In Russian).

Walbarsht, M. L., ed. Laser Applications in Medicine and Biology. Vol. 1 New York: Plenum Press, 1971. xiv + 288pp. illus.

CHAPTER IV

OPTICS: BASIC PRINCIPLES, DESIGN, INSTRUMENTATION PROBLEMS, PLASTIC OPTICS, AND FIBER OPTICS

CHAPTER IV

OPTICS: BASIC PRINCIPLES, INSTRUMENTATION PROBLEMS, DESIGN, PLASTIC OPTICS, AND FIBER OPTICS

Allan, W.B. Fibre Optics: Theory and Practice. London: Plenum Press, Ltd., 1973. 247pp.

Brief historical introduction, with an outline of the theory and practice of the optical fiber. Describes the manufacture of optical fibers and the principle of the light guide. Continues with basic theory of coherent bundles, the spatial resolution of an optical fiber, the image transfer through a coherent bundle and the degradation of contrast resulting therefrom. The author then describes how coherent bundles are manufactured and their ensuing properties; applications of coherent bundles are discussed. A chapter is devoted to waveguide properties of optical fibers. Other topics include the uv and ir transmitting fibers, optical fiber laser and luminescent fibers, concluding with a theoretical description of graded index fibers. The final chapter presents applications of fiber optics to medicine. Includes an extensive bibliography.

Arnaud, J. A. Beam and Fiber Optics. New York: Academic Press, Inc., 1976. 456pp.

Contents: Description of Optical Beams; Gaussian Beams; Wave Equations; The Laws of Geometrical Optics; Multimode Fibers; Piecewise Homogeneous Media, and Fiber Optics.

Barnowski, Michael K. Introduction to Integrated Optics. New York: Plenum Press, Inc., 1974. 515pp. illus.

Series of lectures presented at an annual short course on integrated optics, sponsored by the University of California, Santa Barbara, in March, 1973.

Born, M., and Wolf, E. Principles of Optics: Electromagnetic Theory of Propagation, Interference and Diffraction of Light. 5th ed. New York: Pergamon Press, Inc., 1975. 808pp.

Conrady, A. E. Applied Optics and Optical Design. New York: Dover Publications, Inc., 1957. 518pp. diagrams.

Contains ordinary ray-tracing methods, general theory of perfect optical systems, theory of primary aberrations, and higher aberrations required for the design of all types of telescopes, low-power microscopes and simple objectives.

Cox, Arthur. Photographic Optics. A Modern Approach to the Technique of Definition. 15th ed. A Focal Manual of Photo-Technique. Garden City, New York: Amphoto, Inc., 1974.

Ditchburn, R. W. Light. 3rd ed. New York: Academic Press, Inc., 1976. 822pp.

Extends treatments of thin films, lasers, holography, fibre-optics and wave guides. New material is included on non-linear optics, pico-second impulses and modern interferometry. Includes the theory of the ultimate limits of optical systems considered as devices for obtaining information not otherwise accessible.

Fincham, W.H.A., and Freeman, M.H. Optics. 8th edition. London: Butterworths Ltd., 1974. viii + 482.

Fundamental laws of optics and the development of optical instruments and techniques; including the laser and holography.

Fox, Jerome., ed. Proceedings of the Symposium on Modern Optics. New York, N.Y., March 22-24, 1967. Vol. XVII. [Microwave Research Institute Symposia Series, Polytechnic Press of the Polytechnic Institute of Brooklyn, N.Y.]. New York: Interscience Publishers, Division of John Wiley & Sons, Inc., 1967.

Goncharenko, Andrey M., and Redko, Vsevolod P. Vvedeniye v integralnuyu optiku. ("Introduction to Integral Optics"). Minsk: Izd-vo, "Nauka i tekhnika," 1975. 152pp. illus.

Fundamentals of the theory of propagation of light waves in thin films and heterogeneous dielectric layers with consideration of absorption and anistrophy and problems of the technology of producing thin dielectric films and layers for use in integral optics are both considered. Functional units and apparatus based on thin film light guides are described.

Habell, K.J., and Cox, Arthur. Engineering Optics. The Principles of Optical Methods in Engineering Measurement. London: Sir Isaac Pitman & Sons., Ltd., 1953. 411pp. illus.

Horne, D. F. Lens Mechanism Technology. New York: Crane, Russak & Co., Inc., 1976 [c1975]. 266pp. [$72.50].

Techniques and problems encountered in the manufacture of precision lenses; Still cameras and slide projector systems; Motion picture and television zoom systems; Iris diaphrams and stops; Shutter design and calibration, etc.

Jacobs, Donald H. Fundamentals of Optical Engineering. New York: McGraw-Hill Book Co., Inc., 1943. 487pp. illus.

Contents: Pt. I. Fundamental Considerations; Pt. II . Representative Instruments; Pt. III. Mechanical & Electrical Design. Optical Instrument Design. General Considerations.

Machine Operations and Testing Methods, Bearings, Gears, Clutches, Couplings, Lens Mountings, Parallel Displacements, Electrical Controls, Photoelectric Cells. Optical Design: Ray Tracing, Spherical Aberration, Chromatic Aberation, Coma, Design of Aplanatic Objectives, Eye Piece Design, Optical Tolerances.

Jenkins, Francis A. and Whit, Harvey E. Fundamentals of Optics. 4th ed. New York: McGraw Hill, 1976. 746pp. (Revised and enlarged since last published in 1957).

Kapany, N. S. Fiber Optics: Principles and Applications. New York: Academic Press, Inc., 1967. xviii + 429pp.

Fiber optics although discovered in 1927, lay dormant for many years when it was revived by van Hell in Holland and Hopkins and Kapany in England, in the early 1950's. From the 50's to the 60's was a period of intense interest and research and then a period of decline, possibly due from the technical difficulties experienced in the manufacture of fiber optics. Dr. Kapany who was associated with fiber optics during its "revival" period is the first reseacher to write a book on the principles and applications of fiber optics.

The author introduces the field of fiber optics with a historical background. Light propagation in an optical fiber is then considered from a geometrical-optics point of view, as well as wave guide theory for small fibers; and the coupling of light in parallel fibers. A chapter on image transmission with both static and dynamic scanning is included. The author describes the techniques involved in producing optical fibers, with applications cited in such fields of endeavor as medicine, photoelectronics, photography, high-speed photography and infrared transmission. A brief description is given of active fibers and the characteristics of the radiation field from the center of the fiber are studied. The author has also included three appendices: "Image Transmission Characteristics of Fiber Bundles," by Hitoshi Ohzu; "The Retina as a Fiber Optics Bundle," by J.M. Enoch, and "Space Variant Imagery in Fiber Optics," by M. Van-Wormhoudt, and W. DeKinder. An extensive bibliography is included.

Kingslake, Rudolf., ed. Applied Optics and Optical Engineering: A Comprehensive Treatise. In Five Volumes. New York: Academic Press, Inc., 1965-1969. illus.

Volume 1. Light: Its Generation and Modification. 1965. 423pp. illus.

Photometry; Light Sources for Optical Devices; Filters; Atmospheric Effects; Optical Materials; Basic Geometrical Optics; Diffraction; Interference, and Optical Interference Coatings; Polarization; Projection Screens; Precision and Accuracy. Author Index--Subject Index.

Volume II. The Detection of Light and Infrared Radiation. 1965. 390pp. illus.

The Eye and Vision; Stereoscopy; The Photographic Emulsion;

Combination of lens and Film; Illumination in Optical Images; Electro-Optical Devices; Television Optics; Infrared Detectors; Infrared Equipment. Author Index--Subject Index.

Volume III. Optical Components. 1965. 374pp. illus.

Lens Design; Optical Manufacturing; Photographic Objectives; Microscope Objectives; The Testing of Complete Objectives; Spectacle Lenses; Mirror and Prism Systems; Mirror Coatings; Eyepieces and Magnifiers. Author Index--Subject Index.

Volume. IV. Optical Instruments--Part I. 1967. 396pp.

Fiber Optics; Microscopes; Camera Shutters; Still Cameras; Microfilm Equipment; High-Speed Photography; Optical Workshop Instruments; Radiometry; Interferometers; Refractometry. Author Index--Subject Index.

Volume V. Optical Instruments--Part II. 1969. 382pp.

Dispersing Prisms; Diffraction Gratings; Spectrographs and Monochromators; Spectrophotometers; Colorimeters; Astronomical Telescopes; Military OFtical Instruments; Surveying and Tracking Instruments; Medical Optical Instruments; Opthalmic Instruments; Motion Picture Equipment. Author Index--Subject Index. Cumulative Index for Volumes I - V.

Klein, Miles V. Optics. New York: John Wiley and Sons, Inc., 1970. 647pp.

The principles behind practical optical components and systems and the theory of physical optics.

Lipson, Stephen G. and Lipson, Henry. Optical Physics. London: Cambridge University Press, 1969. 494pp. illus.

Contents: 1. History of Ideas; 2. Waves; 3. Fourier Theory; 4. Electromagnetic Waves; 5. Polarization and Anisotropic Media; 6. Diffraction; 7. Fraunhofer Diffraction and Interference; 8. Coherence; 9. Optical Instruments and Image Formation; 10. The Classical Theory of Dispersion; 11. Quantum Optics; 12. Some Applications of Optical Ideas. Appendices.

Lisitsa, M.P., Berezhinskii, L.I., and Valakh, M. Ya. Fiber Optics. New York: Wiley-Halstead, 1972. 272pp.

Fiber optics is a branch of applied optics. Those who study it are trying to build practical devices. To do so effectively the technology is as important or more important than the theory. In fact most of the theory (though not all) is a simple extension of basic physical optics.

A monograph should then emphasize those parts of the theory that are peculiar to fiber optics, i.e., modes in dielectric waveguides and coupling between adjacent wave-guides, and devote much of the rest to the technology such as choice of glass, drawing of fibers, stacking or assembling, polishing, assembly of faceplate structures, vacuum

sealing of face plates, etc. Clearly it cannot be written by someone not actively engaged in the business.

This monograph fails to meet these criteria. There is no reference in the bibliography to any paper on fiber optics by any of the authors or any internal evidence that they have worked in the field.

The theory is bulky and repetitive of elementary physical optics texts. There is hardly any technology on how fibers are made or manipulated.

Finally, the applications are chosen without discrimination. Very important uses (image intensifiers) are given no more emphasis than some very cumbersome and useless ideas of the kind that are published in the literature because the proposal was rejected. . . .

The book suffers another defect. Only one reference is as recent as 1965. It was printed in Russian in 1968 and published in translation here in 1972. You'll have to get your background in fiber optics elsewhere. Read Kapany.[1]

Mathieu, J. P. Optics. Parts 1 & 2. New York: Pergamon Press, Inc., 1975. 550pp.

Part 1. Electromagnetic optics, including the treatment of phase, propagation equations and crystal optics. Emphasizes the fact that optics extends from far-infrared to x-ray and touches on such topics as Fourier Transform and X-Ray Analysis of crystal structure. (Material is presented on the premise that reader has prior knowledge of electromagnetic theory).

Part 2. Approaches optics from a quantum theory standpoint; Explores relationship between optics and the quantum theory. In situations where quantum theory is not suitable topics are explained with the Wave Theory. A set of problems are presented at the end of each chpater. Solutions and hints are given at the back of the book.

Monk, George S., and McCorkle, W.H. Optical Instrumentation. New York: McGraw-Hill Book Co., Inc., 1954. 262pp. illus.

One in a series of volumes [Volume 8], prepared as a record of the research work done under the Manhattan Project and the Atomic Engergy Commission. Foreword by Lewis L. Strauss, Chairman, U.S. Atomic Energy Commission. The Optics Section of the Metallurgical Laboratory was called upon in the fall of 1945 to design and build many dozens of optical instruments for remote control in irradiated areas.

Part 1 of this volume presents the fundamental requirements as they appeared at that time and the general way in which they were met. Part II. is a series of condensed reports describing typical instruments which were built and certain technical processes essential to work of the section.

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[1]W. Lewis Hyde, "Fiber Optics," A Review. Applied Optics. Vol. XIII, No. 1 (January, 1974), p. 213.

Nussbaum, Allen and Phillips, Richard A. Contemporary Optics for Scientists and Engineers. New York: Prentice Hall, 1976. 511pp.

This book is organized into four sections: Elementary and Advanced Geometrical Optics; The Wave Properties of Light; The Fourier Analysis Approach to Physical Optics; and the Interaction of Light and Matter. Background and elementary discussions within each section takes a basic approach, making this not only a text from which to teach but also serves as a good reference text. Topics include basic optical design (including some basic computer programs that can be "plugged in" and used), interferometry, holography, crystal optics, polarization, lasers, detectors, miscallaneous optical sources, etc.

Optical Industry and Systems Directory; 1977. 23rd edition. In Two Volumes. Pittsfield, Mass.: The Optical Publishing Co., Inc., 1976. 1053pp. illus.

This edition is a standard reference work covering the field of optical instrumentation, systems design and Fabrication. It is a Buyers Guide [Vol. I], to the Optical/Electro-Optical/Laser Industry with added features of an Encyclopedia and Dictionary [Vol. II]. In the Encyclopedia each section begins with a definition and background summary of the subject to better acquaint the user with the material. The Dictionary--revised for 1977--contains over 4,000 technical terms amplified by detailed illustrations.

Optical Space Communication. [Proceedings of an MIT-NASA Workshop held at Williams College, Williamstown, Mass., August 4-17, 1968. NASA No. SP-217. Edited by Robert S. Kennedy and Sherman Kays. (Cambridge, Mass.: Massachusetts Institute of Technology)]. Washington, D.C.: NASA, 1969. 147pp.

Rediker, Robert H. Optics Research--1975. [Report ESD Tr-75-252]. 7 NOVEMBER, 1975. Lexington, Mass.: Lincoln Laboratory, MIT, 1975. 56pp. illus. [Unclassified].

SemiAnnual Technical Summary Report for the Advanced Research Projects Afency (ARPA). This report covers work of the Optics Division at the Lincoln Laboratory for the period 1 January-30 June 1975. The topics covered are laser technology and propagation and pollution studies.

Rodichev, V. I., ed. Tvortzi fizicheskoy optiki: Sbornik. ("Creators of Physical Optics: A Collection of Papers"). Moscow: Izd-vo, "Nauka," 1973. 352pp.

A selected collection with little mathematics consisting of 25 chapters; about half translated from English and French

originals into Russian from the writings of the great pioneers in physical optics, the other half consisting of biographical sketches or appreciations of these pioneers.

The book is arranged into four principle sections: 1st Section: The early contributors (pre-1750)--selections from Descartes, Huygens, and Newton; An appreciation of Robert Hooke, two surveys of early experimental optics, four brief articles by William Emmoton. Some early experiments in physical optics that originally appeared in The Optician (1961), and an article by Middleton on the beginnings of photometry from the American Journal of Physics (1963). Second Section: (1750-1850). Includes selections of Thomas Young, Fresnel and Fizeau, a biographical sketch of Young, A survey of Young and the theory of diffraction by Rubinowicz (from Nature, 1957) and two appreciations of Fresnel (one from the foreword of his complete works). Section Three: Surveys 1850-1920--with emphasis on Maxwell, Rayleigh and Michelson; A letter from Maxwell to D.R. Todd of 19 March 1879 (published by Stokes in Nature, 1880). An article by Michelson on the relative motion of the earth and ether (from American Journal of Science, 1881). A 1967 ISIS article by Shankland on Rayleigh and Michelson; Rayleigh's 1889 paper on blackbody radiation; L. Essen's endeavour paper summarizing the principle speed of light measurements through 1954 (published in 1956) and a more recent Russian paper by I. Ya. Itenberg on more recent speed of light measurements by Karolus and others using laser techniques. Another paper describes Michelson's improvements to Fizeau's method of measuring the speed of light. Section Four: Emphasizes Russian contributions to classical physical optics: P.N. Lebedev (1866-1912), I. Mandelshtam (1876-1940), D.S. Rozdestvenski (1876-1940), S.L. Vavilov (1891-1951). The section by Rozdestvenski is not concerned with the "hook" method for which he is best known, but instead is concerned with the history of microscopy. General level of this collection is more narrative in the form of popular lectures on physics.

Rousseau, M., and Matheiu, J. P. Problems of Optics. Translated by J.W. Blaker. New York: Pergamon Press, Inc., 1973. 336pp., + ixpp.

A translation from the French of a collection of problems with solutions in physical optics. Problems are interesting and imaginative, and the solutions are convincing and easy to follow. The collection is divided into eight sections varying in length from 15 pages to 66 pages. An 18 page appendix is included on Fourier Transform. Most sections cover standard topics of physical optics, such as interference, diffraction, the Fresnel formulas, black body radiation and dispersion. In addition sections are included on quantum mechanics and atomic and molecular spectra.

Russian-English Glossary of Optics and Spectroscopy. Edited by I. Emin; compilation and composition by Sonia Noveck. New York: Interlanguage Dictionaries Publishing Corp., 1959. 78pp.

A compilation of terms and expressions taken from numerous articles on various topics in the fields of optics and spectroscopy.

Schepler, Herman C. Optical Alignment Notes. 26 May 1959. Redstone Arsenal, Alabama: Systems Support Equipment Laboratory, Development Operations Division, Army Ballistic Missile Agency, 1959. 36pp. diagrams.

Introduction to optical alignment principles. Optical Alignment. 1. Introduction; 2. Principles of Optical Alignment; 3. Instrumentation; 4. Properties of Light; 5. Properties of Materials; 6. Refraction; 7. Reflection; 8. The Telescope; 9. Objective Lens of Telescope or Collimator; 10. The Collimator and Auto-Collimator; 12. Design of Reticules (Reticule or Graticule); 13. Adjustment of the Collimator; 14. Reticule Scales; 15. Uses of the Collimator. [Also includes Constants, Angular Conversion Tables, Equations].

Sliusarev, G. G. Raschet opticheskikh sistem. ("Methods for the Design of Optical Systems"). Leningrad: Izd-vo, Mashinostroenie, 1975. 640pp. 99refs. [in Russian].

This book provides extensive design information for a wide range of optical materials and systems, including telescopic systems, microsopes, reflector and reflector-lens systems, prisms, optical delay lines, and illuminating systems.

Society of Photo-Optical Instrumentation Engineers. Basic Optics and Optical Instruments. Vol. 1. Redondo Beach, Calif.: Society of Photo-Optical Instrumentation Engineers, 1965. xv + [137]pp. illus.

Preface: This course in Basic Optics and Optical Instruments has been compiled from various sources. . . .

The theory of optical phenomena is neither rigidly demonstrated nor profound in concept, but is presented in a manner which will develop. . .a desire for additional knowledge which can be gained through his own efforts. . . . A minimum of theory is used and only when pertinent to the phenomena under consideration. . . .

The purpose of this course is to help the user of optical instruments become more familiar with optics and certain instruments. First, the various phenomena of light and associated theory are considered. Simultaneously with the study of light phenomena, the appropriate optical components are studied, along with the assembled components that make up the special purpose instruments.

Sotskov, B. S., ed. Opticheskaia i elektroopticheskaia obrabotka informatsii. ("Optical and Electro-Optical Information Processing"). Moscow: Izd-vo, "Nauka," 1974. 159pp.

A compilation of papers on optical data processing including photo-electric converters, electro-optical modulation in lasers, treatment of wide-band processes with time freqency bias and information processing automation. Other topics include resolutuion of astronomical instruments, scanning in laser readout devices, digital display systems, photo multipliers, and optical information inputs and outputs.

Soule, Harold V. Electro-Optical Photography at Low Illumination Levels. New York: John Wiley and Sons, Inc., 1968. 392pp. illus.

This book is devoted to the subject of low light level electro-optical photographic systems. Emphasis is on the general properties and applications of night imaging with the inclusion of sufficient technical data to allow for conceptual design of an instrument for special purpose.

Contents: 1. Survey of Electro-Optical Imaging; 2. Night Illumination; 3. Image-Intensifier Characteristics; 4. Low Light Level Lens Systems; 5. Image-Intensifier Electronography; 6. Low Light Level Television; 7. Photographic Recording of Phosphor Displays; 8. Unique Television Recording Techniques; 9. Image Recording Materials; 10. Low Light Level Instruments and their Applications; 11. Physics of Low Light Level Electro-Optical Components; 12. Comparison of Imaging Sensors; 13. Mathematical Analysis of Electronography; 14. Low Light Level Image Evaluation; 15. Military Utilization of Passive Night Imaging. Bibliography, p. 367. Index, p. 389.

Southall, James C. Mirrors, Prisms and Lenses: A Text-Book of Geometrical Optics. Third edition. New York: Dover Publications, Inc., 1964.

An unabridged and unaltered republication of the third edition published by the Macmillan Company in 1933.

Contents: Chapter 1. Lights and Shadows; 2. Reflection of Light. Plane Mirrors; 3. Refraction of Light; 4. Refraction of a Plane Surface and also through a Plate with Plane Parallel Faces; 5. Refraction through a Prism; 6. Reflection and Refraction of Paraxial Rays at a Spherical Surface; 7. Refraction of Paraxial Rays through an Infinitely Thin Lens; 8. Change of Curvature of the Wave-Front in Reflection and Refraction. Dioptry System; 9. Astigmatic Lenses; 10 Geometrical Theory of the Symmetrical Optical Instrument; 11. Compound Systems.

Thick Lenses and Combinations of Lenses and Mirrors; 12. Aperture and Field of Optical Systems; 13. Optical System of the Eye. Magnifying Power of Optical Instruments; 14. Dispersion and Achromatism; 15. Rays of Finite Slope. Spherical Aberration. Astigmatism of Oblique Bundles, etc.; 16. Miscellaneous Notes; 17. The Microscope. I. The Magnifying Glass (or Simple Microscope); II. The Compound Microscope. 18. Notes on Physical Optics and Physiological Optics. I. Double Refraction; II. The Ophthalmometer; III. Visual Acuity in Daylight Vision; IV. The Color Sensations; V. Perceptions of Depth in Binocular (Stereoscopic) Vision; VI. Concerning the Nature of Light. Fresnel's Wave Theory; Maxwell's Electro Magnetic Theory; Modern Theories. Index.

U.S. Department of Commerce. National Bureau of Standards. Precision Measurement and Calibration: Image Optics. Vol. 10. NBS Special Publication 300. Edited by Calvin S. McCamy. Washington, D.C.: U.S. Government Printing Office, 1973. 953pp. illus.

Abstract: This volume is one of an extended series which brings together the previously published papers, monographs, abstracts and bibliographies by NBS authors dealing with precision measurement of specific physical quantities and the calibration of related metrology equipment.

The contents have been selected as being useful to the Standards Laboratories of the United States in tracing to NBS standards the accuracies of measurement needed for research work, factory production, or field evaluation.

Vol. 10 deals with image optics, including photography. It contains 62 reprints assembled in 4 sections (1) Refractometry and Optical Homogeneity, (2) Interferometry in Image Optics, (3) Optical Design and Image Evaluation, (4) Photographic Science. Each section is introduced by an interpretive foreword.

U.S. Precision Lens Co., Inc. The Handbook of Plastic Optics. (with Emphasis on Injection-Molded Optics) 1st edition. Introduction by Roger L. Howe, President. Cincinatti, Ohio: U.S. Precision Lens Co., Inc., 1973. 105pp. illus.

Contents: I. Types of Plastic Optics; 2. Principal Optical Plastics; 3. Reflective, Antireflective, Antiabrasive, Antistatic; 4. Optical Design with Plastic Materials; 5. Optical Tooling. Tables. Glossary of Optical Terms.

Van Heel, A.C.S., ed. Advanced Optical Techniques. New York: John Wiley & Sons, Inc., 1967. 628pp. illus.

A compilation to include: Precision Measurements, Spectroscopy, Interferometry, Optics of Thin Films, The Theory of Coherence and its Applications, Use of Spheres in Optics, Modern Light Sources, Fiber Optics, Lasers, Optical Glass, Geometrical Optics, etc.

Wolf, Emil., ed. Progress in Optics. Vol. 1 [Second Reprint Edition]. Amsterdam: North-Holland Publishing Co., and New York: Interscience Publishers, A Division of John Wiley and Sons, Inc., 1965. 342pp. illus.

A compilation of materials by various authors to include:

I. The Modern Development of Hamiltonian Optics. R.J. Pegis.
II. Wave Optics and Geometrical Optics in Optical Design. K. Miyamoto.
III. The Intensity Distribution and Total Illumination of Aberration-Free Diffraction Images. R. Barakat.
IV. Light and Information. D. Gabor.
V. On Basic Analogies and Principal Differences Between Optical and Electronic Information. H. Wolter.
VI. Interference Color. H. Kubota.
VII. Dynamic Characteristics of Visual Processes. A. Fiorenti.
VIII. Modern Alignment Devices. A.C.S. Van Heel.

______. Progress in Optics. Vol. II. Amsterdam: North-Holland Publishing Co., 1963 [1st Reprint 1968], 298pp. illus.

A compilation of materials by various authors.

I. Ruling, Testing and Use of Optical Gratings for High-Resolution Spectroscopy. G.W. Stroke.
II. The Metrological Applications of Diffraction Gratings. J.M. Burch.
III. Diffusion through Non-Uniform Media. R.G. Giovanelli.
IV. Correction of Optical Images by Compensation of Aberrations and by Spatial Frequency Filtering. J. Tsujiochi.
V. Fluctuations of Light Beams. L. Mandel.
VI. Methods for Determining Optical Parameters of Thin Films. F. Abeles.

______. Progress in Optics. Vol. III. Amsterdam: North-Holland Publishing Co., 1964. 340pp. illus.

A compilation of materials by various authors.

I. The Elements of Radiative Transfer. F. Kottler.
II. Apodisation. P. Jacquinot and B. Roizen-Dossier.
III. Matrix Treatment of Partial Coherence. H. Gamo.

______. Progress in Optics. Vol. IV. Amsterdam: North Holland Publishing Co., 1965. 327pp. illus.

A compilation of materials by various authors.

I. Higher Order Aberration Theory. J. Focke.
II. Applications of Sheering Interferometry. O. Bryngdahl.
III. Surface Deterioration of Optical Glasses. K. Kinosita.
IV. Optical Constants of Thin Films. P. Rouard and P. Bousquet.
V. The Miyamoto-Wolf Diffraction Wave. A. Rubinowicz.

VI. Aberration Theory of Gratings and Grating Mountings. W.T. Welford.
Diffraction at a Black Screen. Part I: Kirchhoff's Theory. F. Kottler (pp. 281-314).

______. Progress in Optics. Vol. V. Amsterdam: North-Holland Publishing Co., 1966. 383pp. illus.

A compilation of materials by various authors.

I. Optical Pumping. C. Cohen-Tannoudji and A. Kastler.
II. Non-Linear Optics. P.S. Pershan.
III. Two-Beam Interferometry. W.H. Steel.
IV. Instruments for the Measuring of Optical Transfer Functions. K. Murata.
V. Light Reflection from Films of Continuously Varying Refractive Index. R. Jacobsson.
VI. X-Ray Crystal Structure Determination as a Branch of Physical Optics. H. Lipson and C.A. Taylor.
VII. The Wave of a Moving Classical Electron. J. Picht.

______. Progress in Optics. Vol. VI. Amsterdam: North-Holland Publishing Co., [1st Reprint 1971], 1967. 388pp. illus.

Contents:

1. Recent Advances in Holography.
II. Scattering of Light by Rough Surfaces.
III. Measurement of the Second Order Degree of Coherence.
IV. Design of Zoom Lenses.
V. Some Applications of Lasers to Interferometry.
VI. Experimental Studies of Intensity Fluctuations in Lasers.
VII. Fourier Spectroscopy.
VIII. Diffraction at a Black Screen. Part II. Electromagnetic Theory, F. Kottler. [A posthumous publication by F. Kottler--the continuation of his articles on Diffraction at a Black Screen, the First Party appeared in Volume IV]. References, p. 376; Author Index, p. 379; Subject Index, p. 384.

______. Progress in Optics. Vol. VII. Amsterdam: North-Holland Publishing Co., 1969. 431pp. illus.

Contents:

I. Multiple-Beam Interference and Natural Modes in Open Resonators.
II. Methods of Synthesis for Dielectric Multilayer Filters.
III. Echoes at Optical Frequencies.
IV. Image Formation with Partially Coherent Light.
V. Quasi-Classical Theory of Laser Radiation.
VI. The Interaction of Very Intense Light with Free Electrons.

______. Progress in Optics. Vol. VIII. Amsterdam: North-Holland Publishing Co., 1970. 458pp. illus.

Contents:
I. Synthetic-Aperture Optics.
II. The Optical Performance of the Human Eye.
III. Light Beating Spectroscopy.
IV. Multilayer Antireflection Coatings.
V. Statistical Properties of Laser Light.
VI. Coherence Theory of Source-Size Compensation in Interference Microscopy.
VII. Vision of Communication.
VIII. Theory of Photoelectron Counting.

______. Progress in Optics. Vol. IX. Amsterdam: North-Holland Publishing Co., 1971. 422pp. illus.

Contents:
I. Gas Lasers and their Applications to Precise Length Measurements.
II. Picosecond Laser Pulses.
III. Optical Propagation through the Turbulent Atmosphere.
IV. Synthesis of Optical Birefringent Networks.
V. Mode Locking in Gas Lasers.
VI. Crystal Optics with Spatial Dispersion.
VII. Applications of Optical Methods in the Diffraction Theory of Elastic Waves.
VIII. Evolution, Design and Extrapolation Methods for Optical Signals based on the use of the Prolate Functions.

______. Progress in Optics. Vol. X. Amsterdam: North-Holland Publishing Co., 1972. 393pp. illus.

Contents:
I. Bandwidth Compression of Optical Images.
II. The Use of Image Tubes as Shutters.
III. Tools of Theoretical Quantum Optics.
IV. Field Corrections for Astronomical Telescopes.
V. Optical Absorption Strength of Defects in Insulators.
VI. Elastooptic Light Modulation and Deflection.
VII. Quantum Detection Theory.
References[724 literature references], Author Index, Subject Index

______. Progress in Optics. Vol. XI. Amsterdam: North-Holland Publishing Co., 1973. 357pp. illus.

The aim of this series is to present authoritative review articles on an international basis, contributed by prominent workers in the broad area of theoretical and experimantal optics.

Contents:

I. Master Equation Methods in Quantum Optics.
II. Recent Developments in Far Infrared Spectroscopic Techniques.
III. Interaction of Light and Acoustic Surface Waves.
IV. Evanescent Waves in Optical Imaging.
V. Production of Electron Probes Using a Field Emission Source.
VI. Hamiltonian Theory of Beam Mode Propagation.
VII. Gradient Index Lenses.
Author Index/Subject Index. Cumulative Index Vol's. I-XI

______. Progress in Optics. Vol. XII. Amsterdam: North Holland Publishing Co., 1974. 362pp. illus.

The aim of this series continues to be to present authoritative review articles on an international basis, contributed by prominent workers in the broad area of theoretical and experimental optics.

Contents:

I. Self-Focusing, Self-Trapping, and Self-Phase Modulation of Laser Beams.
II. Self Induced Transparency.
III. Modulation Techniques in Spectrometry.
IV. Interaction of Light with Monomolecular Dye Lasers.
V. The Phase Transition Concept and Coherence in Atomic Emission.
VI. Beam-Foil Spectroscopy.
Author Index/Subject Index. Cumulative Index Vol's. I-XII.

Yelnikov, Nikolay T., Ditev, Aleksandr F., & Yurusov, Igor K. Sborka i yustirovka optiki-mekhanicheskikh priborov. ("Assembly and Adjustment of Optico-Mechanical Instruments"). Moscow: Mashinostroyeniye, 1974. 352pp.

A manual for technicums. General information is given on assembly and adjustment of optico-mechanical instruments. Methods of assembly with mechanical parts are described and adjustment and control operations are examined.

Zernike, Frits, and Midwinter, John E. Applied Nonlinear Optics. [A Wiley-Interscience Publication], New York: John Wiley & Sons, Inc., 1973. 199pp. illus.

Directed to physicists and engineers interested in device applications made possible by the development of nonlinear optics. This book is written entirely on a classical basis and no knowledge of quantum mechanics other than the most elementary ideas is required of the reader. However, a working knowledge of the elements of calculus and of electro-magnetic theory is assumed. Includes 175 references.

CHAPTER V

REFERENCE MATERIALS: DICTIONARIES, HANDBOOKS, GUIDEBOOKS, ENCYCLOPEDIAS, GLOSSARY'S AND SELECTED COLLECTIONS

CHAPTER V

REFERENCE MATERIALS: DICTIONARIES, HANDBOOKS, GUIDEBOOKS, ENCYCLOPEDIAS, GLOSSARY'S AND SELECTED COLLECTIONS

American Society of Cinematographers. American Cinematographers Manual. 4th ed. Compiled and edited by Charles G. Clarke, A.S.C., and Walter Strenge, A.S.C. Hollywood: American Society of Cinematographers, 1973. 655pp. illus.

A reference manual--supplys the filmmaker with data required to select equipment and supplies in order to film the picture with greater accuracy, speed and efficiency. Contents Include: Photographic Systems, Cameras, Threading Diagrams, Lens Angle Tables, Films--Black-and-White and Color, Footage Tables, Infrared Cinematography, Camera Panning Speed Recommendations, Helicopter Photography, Exposure and Photometric Materials, Conversion Tables, Optical Printing, Television, Super 8-mm, Lighting, Electrical Data, Underwater Photography, Process Photography, Front Projection, Day for Night, Arctic Cinematography, Tropic Cinematography, C or Temperature and Color Photography, Filters, Projection, Projectors, Marking Prints to Indicate Effects, Sound, Camera Trouble Shooting, Glossary. A List of Motion Picture Technical Terms in Five Languages (English, Spanish, French, Italian and German).

Brown, F. M., Hall, H. J., and Kosar, J., eds. Photographic Systems for Engineers. Washington, D.C.: Society of Photographic Scientists and Engineers, 1966. 215pp.

A compilation of papers from previous "SPSE" Seminars. This book emphasizes photographic processes and techniques and their application as measuring, data collection and information storage methods. Design criteria has been included for the development of photographic equipment and for the efficient use of existing equipment.

Contents: Introduction to Photographic Systems; Photographic Sensitivity; Photographic Sensitometry; Photographic Lenses; The Use and Measurement of Lenses; Data Projection--

Light Sources and Optics; Film and Paper Processing Techniques; Film Handling and Image Registration; Control of Tone Reproduction; Information Capacity of Photo Materials.

Chamberlain, Katherine. An Introduction to the Science of Photography. New York: Macmillan Co., 1951. 292pp.

An elementary text for classroom or self study. Questions, problems and additional reading references are supplied at the end of chapters. A portion of the questions are answered in the appendix.

The several experiments included do not involve camera, enlarging, photographic emulsion or developing process. This book is more of a guide to the physics of photography (rather than chemistry of Photography) in that it involves simple lens effects, exposure calculations, types of equipment and a general discussion of the photographic process. It is slanted to the general reader who has a desire to know more on the subject than generally included in operation manuals and guides accompaning specific equipment.

Cimerman, Vjekoslav and Tomosegovic, Zdenko. Atlas of Photogrammetric Instruments. New York: Elsevier Publishing Co., 1970.

Attempts to answer questions concerning photogrammetric instruments and accessories such as: What is Produced, Which Company Manufactures the Products and Where is that Company Operating? The material has been divided into ten chapters on the basis of the technological processing sequence in photogrammetry. Text and photographs present the most-up-to-date survey of photogrammetric instruments. Bibliography is included, page 211.

Clark, Frank P., ed. Technologies in the Laboratory Handling of Motion Picture and Other Long Films. Proceedings-- Two-day Tutorial Seminar SMPTE/SPSE New York: Co-Sponsored by the SMPTE/SPSE, Washington, D.C., 223pp. illus.

Contents: Seminar Committee; Preface (Alan M. Gundelfinger and John R. Sullivan, Co-Chairman). 1. Is Film Where It's At, Kenneth M. Mason, p. 1; 2. The Modern Motion Picture Laboratory, Ted Fogelman, p. 9; 3. Raw Stocks, Dr. Frank P. Brackett, Jr., p. 23; 4. Fundamentals of Light and Color, Edward P. Ancona Sr, p. 31; 5. Photographic Processing Chemistry, Dr. Fred Porter, p. 35; 6. Chemical Systems, Robert F. Allaire, p. 49; 7. Film Processing--Equipment and Control, Ralph D. Whitmore, p. 69; 8. Wide-Film Tracking in Commercial Processors, Robert Schram, p. 85; 9. Inter-Lab Standarization of

Processing and Printing Controls, Dr. LeRoy M. Dearing, p. 103; 10. Sensitometry, Sidney P. Solow, Roderick T. Ryan, p. 113; 11. Film Printing, Black-and-White and Color, Jack P. Hall, p. 141; 12. Optical Printing Techniques, Joseph W. Schmit, p. 159; 13. Sound and the Laboratory, Fred J. Scobey, p. 179; 14. Projection and Evaluation, p. 185; 15. The Impact of Modern Technologies on the Future of the Laboratory, Wilton R. Holm, p. 203; 16. Bibliography, p. 221.

Clulow, Fredrick W. Color Its Principles and Their Applications. New York: Morgan & Morgan, Inc., 1972; London: Fountain Press Ltd., 1972. 236pp. illus.

Simple explanation of the theory of color and practices of color reproduction. Contents: 1. Light and Color; 2. General Properties of Coloured Materials; 3. Special Cases; 4. Colour Vision; 5. Colour Mixing Processes; 6. Colour Measurement; 7. Additive Reproduction Methods; 8. Subtractive Reproduction Methods. Bibliography for Further Reading,pp. 223-224. Index, p.225.

Committee on Colorimetry. Optical Society of America. The Science of Color. Introduction by Loyd A. Jones, Chairman. Washington, D.C.: Optical Society of America, 1963. [Fifth Printing, May 1966 by Edwards Brothers, Inc., Ann Arbor, Michigan]. 385pp. illus.

A definitive account of the science of color beginning with a popular history of the use of color during the ages of Babylon, Egypt, Crete, Greece and Rome. Succeeding chapters are concerned not only with the techncial aspects but the philosphy of color; the anatomy and physiology of color vision, the psychology of color (sensory basis of color expe..ience and emotional effects that dominate our perceptions of color), the physical principles that underlie the occurrence of color; and finally psychophysics--that has made the measurement and control of color possible.

Contents: Preface, v; Illustration and Tables, ix; Introduction: The Historical Background and Evolution of the Colorimetry Report, p. 3; 1. From the Art of Coloring to the Science of Color, 16; 2. The Concept of Color, p. 45; 3. Anatomy and Physiology of Color Vision, p. 69; 4. Psychological Concepts; Perceptual and Affective Aspects of Color, p. 145; 6. Physical Concepts: Radiant Energy and its Measurement, p. 172; 7. Psychophysics of Color, p. 220; 8. Quantitative Data and Methods for Colorimetry, p. 254; 9. Colorimeters and Color Standards, p. 317; References, p. 341; Glossary-Index, p. 363.

Eastman Kodak Company. Color as Seen and Photographed. 2nd edition. Kodak Publication No. E-74. Rochester, N.Y.: Eastman Kodak Co., 1966. 68pp. illus.

Eynard, Raymond A., ed. Color: Theory and Imaging Systems. Washington, D.C.: Society of Photographic Scientists and Engineers, 1974.

Frieser, Hellmut. Photographishche Information Saufzeichnung. ("Photographic Information Recording"). New York: Halsted, Div. of John Wiley & Sons, 1975. 592pp.

Contents: Object und bild; Übertragung grosser details. Wiedergabe kleiner details. Kornstruktur entwickelter photographischer schichten; Detail wiedergabe; Detail Wiedergabe bei praktischen photographischen systemen. Anhang Literaturverzeichnis; Sachwort verzeichnis; Auto renverzeichnis; Bkürzungen und formelzeichen.

GE Flashtube Data Manual. [Publication No. PS-62P]. Nela Park, Cleveland, Ohio: Photolamp Department, 43pp.

Giebelhausen, Joachim., ed. Manual of Applied Photography. [English Language editor E.F. Linssen, Publisher Nikolaus Karpf]. Munich, West Germany: Verlag Grossbild-Technik GmbH. 1961. 372pp. illus., diagrams and tables.

A guide to the versatile and up-to-date use of modern medium and large-format cameras with the collaboration of 25 experienced photographers in their special field, in 25 chapters. Provides a wealth of applicable data based on practical experience in all areas of professional photography as an aid to scientific study for purposes of documentation, information, and to underline a specific theory in criminal photography as a means of presenting evidence.

Gorshkov, M. M. Ellipsometriya. ("Ellipsometry"). Moscow: Izd-vo, "Sovetskoye radio" ("Soviet Radio"), 1974. 200pp.

The new science of ellipsometry, its theoretical and experimental principles, for optical investigation of surface properties and processes at a phase interface.
Material is supplied with respect to scattering from surfaces and aspects of polarized light. All current ellipsometric measurement schemes are treated in detail, including descriptions of apparatus, calibration, sensitivity, precision and interpretation using graphical methods and computers. Applications to semiconductors, absorption processes in physical electronics, kinetics of surface film formation, corrosion, physical chemistry, medicine and biology are discussed.

Gosudarstvennyi komitet soveta ministrov sssr po kinemato-grafii. Soyuz kinematografistov sssr. Vsesoyuznyi nauchno-issledovatel'skii kinofotoinstitut. ("State Committee of the Council of Ministers U.S.S.R., for Cinematography. Union of Film Workers of the U.S.S.R. All-Union Scientific-Research Cinema-Photo-Institute"). Sbornik tezisov dokladov pervoi vsesoyuznoi nauchno-tekhnicheskoi konferentsii "Elektronika v kinematografii." ("Collected Theses Reports of the First All-Union Scientific-Technical Conference 'Electronics in Cinema-tography.'"). Moscow--May 28-30, 1974. Moscow: NIKFI ("Nauchno-Issledovatel'skii kinofotoinstitut"), 1974. 138pp. diagrams.

Gottesman, Ronald and Geduld, Harry M. Guidebook to Film; An Eleven-in-One-Reference. New York: Holt, Rinehart and Winston, Inc., 1972. 230pp.

Gregory, R. L. Eye & Brain; The Psychology of Seeing. Vol. 1. World University Library, International Series. New York: McGraw-Hill Book Co., 1966. 254pp. illus.

GTE Sylvania. Lighting Handbook. 5th ed. [For Television, Theatre, Professional Photography. Foreword by Robert E. Levin]. Danvers, Mass.: GTE Sylvania Lighting Center, 1974. 108pp.

Technical information on lights and lighting techniques, applications and helpful hints--glossary and references.

Illuminating Engineering Society. IES Lighting Handbook. [The Standard Lighting Guide]. 5th edition. Edited by John E. Kaufman; Associate editor Jack F. Christensen. New York: Illuminating Engineering Society, 1972.

A revised and expanded edition with 26 sections and full-color illustrations. Includes a dictionary with over 560 lighting terms, including those related to new sources and concepts, such as high-intensity discharge sources and applications.

Contents: Section 1. Dictionary of Lighting Terms; 2. Physics of Light; 3. Light and Vision; 4. Measurement of Light and other Radiant Energy; 5. Color; 6. Light Control and Luminaire Design; 7. Daylighting; 8. Light Sources; 9. Lighting Calculations; 10. Interior Lighting Design Approaches; 11. Office and Schools, Institutions and Public Buildings; 13. Lighting and Merchandising; 14. Industries; 15. Residential Lighting; 16. Lighting System Design Factors; 17. Outdoor Lighting Applications; 18. Light Projection Equipment and Protective Lighting; 19. Sports Lighting; 20. Roadway Lighting; 21. Aviation Lighting; 22. Transportation Lighting; 23. Lighting for Advertising; 24. Theatre, Television and Photographic Lighting; 25. Miscellaneous Applications of Radiant Energy; 26. Underwater Lighting.

Langford, Michael J. Advanced Photography: A Grammar of Techniques. 2nd ed. The Focal Library. London and New York: The Focal Press, Ltd., 1972. 435pp. illus.

Approaches its subject from the point of view of a professional photographer. Section I. Camera and Lighting; Problems of Lens Design; Modern Lens Types; Image Quality and Calculations; Shutters and Related Camera Equipment; Tungsten and Flash Lighting Equipment; Flash in Practice.

Section II. Photography in Monochrome: Origins of the Photographic Process; Latent Image Concept; Image Structure, Developers and Fixation; Tone Reproduction; Printing--Unusual Materials, Effects and Toning.

Section III. Colour Photography: How Colour Emulsions Work; The Odds Against Accurate Colour Photography; The Technical Performance of Colour; Colour Operating; Colour Processing and Printing.

Section IV. Applied Photography: Photography and Graphic Reproduction.

Appendices: I. Optical Calculations; II. Polarized Light; III. CIE Colour Classification System; IV. Contrast Index; V. Chemical Formulae. Index.

______. Professional Photography. New York: Amphoto, 1974. 312pp. illus.

Covers Training, Studio Work, Special Effects, On Location, Darkroom Facilities, Career Opportunities, The Business Side, Management Sales Promotion, Medical, Scientific and Technical Photography.

Lapedes, Daniel N., editor in chief. Dictionary of Scientific and Technical Terms. New York: McGraw-Hill, Inc., 1974. 1650pp. illus.

Over 100 scientific areas, from acoustics and aerospace to virology and zoology are covered in this dictionary of terms, including brief definitions of these fields. Appendix includes information about the International System of Measurement, with conversion tables from U.S. Standard; Mathematics; Semiconductor and electronic symbols; and international graphic symbols.

Lassiter, Kenneth T. Researching Technical Literature. [A paper presented by the author before the 14th National Photographic Conference in Chicago, Illinois, August 11, 1966. Reprinted from the Professional Photographer (December, 1966), Professional Photographers of America, Inc., Kodak Pamphlet No. 1-18-2/67-E. Rochester, N.Y.: Eastman Kodak Co., 1967. 4pp.

Lowman, Charles E. Magnetic Recording. New York: McGraw-Hill Book Co., Inc., 1972. 285pp. illus.

A practical guide to the technology of magnetic recorders used in such fields as audio recording, broadcast and closed-circuit television, instrumentation recording and computer data systems. The author discusses applications, television

recorders, direct and FM signal electronics from lowband to very wide band, servo-control and signal record/playback circuitry, capstan reel and head-drum servos for longitudinal, rotary, helical scan and disc recorders. Definitions included.

Mason, L.F.A. Photographic Processing Chemistry. 2nd ed. New York: John Wiley & Sons Inc., 1975. 326pp.

Practical formulations and theoretical considerations on the mechanism of development and chemistry of developing agents. Covers processing stages other than development, color processing, current views on the mechanism of the color development reaction and typical processing sequences.

Ryan, Roderick T., ed. Principles of Color Sensitometry. 3rd Ed. Scarsdale, N.Y.: SMPTE Inc., 1974. 128pp. illus.

Contents; Introduction; Fundamentals of Sensitometry; The Processing of Sensitometric Tests; Quantitative Evaluation of Image Density; Densitometer Design Principles; Interpretation of Sensitometric Results; Statistical Aspects of Color Sensitometry; Appendix: Transformations between Spectral and Analytical Densities. Bibliography.

Schaffert, R.M. Electrophotography. 2nd Ed. Revised. N.Y.: John Wiley & Sons Inc., 1975. 1000pp.

In-depth coverage of available technology and science concerning the subject; Includes technical descriptions of electrophotographic processes, the theory of electrophotography, and an annotated bibliography of literature and U.S. patents. For Technical Photographers and Engineers.

Schreyre, R., Maurer, S., and Wolter, F.W. The Four Language Dictionary of Photography and Cinematography: English, German, French, Russian. London and New York: The Focal Press, Ltd., 1961. 328pp.

Sellers, Robert C. Basic Training Guide to the New Metrics and SI Units. Washington, D.C.: National Tool, Die and Precision Machinery Association, 1972. 63pp.

Shurcliff, William A. Polarized Light: Production and Use. Cambridge, Mass.: Harvard University Press, 1962. 207pp.

Contents: Conventional Description of Polarized Light; Modern Description of Polarized Light; Polarizers: Classes and Performance Parameters; Dichroic Polarizers; Birefringence Polarizers; Reflection; Retarders and Circular Polarizers; Mueller Calculus and Jones Calculus; Applications to the Control of Intensity, Glare, and Color; Other Applications to Science and Technology. Appendix I. Direction Production of Polarized Light; II. Standard Mueller Matrices and Jones Matrices; Bibliography (p. 173); Index (p. 203).

Society of Motion Picture and Television Engineers. Control Techniques in Film Processing. Prepared by a Special Subcommittee of the Laboratory Practice Committee of the SMPTE; Chairman Walter I. Kisner; Foreword by E. H. Reichard, Chairman SMPTE Laboratory Practice Committee. New York: SMPTE, 1960 [Second Printing, 1965], 181pp. illus.

Contents: Foreword, p. 5; 1. Introduction; 2. General Principles of Process Control; 3. General Aspects of Film Processing; 4. Mechanical Evaluation and Control; 5. Instruments for Photographic Control; 6. Control Strips and Sensitometric Curves; 7. Sensitometric Control of a Standardized Process; 8. Chemistry of Film Processing; 9. Economic Considerations in Establishing a Process Control System. Conclusion. Subcommittee Members and their Affiliations. Index (p. 179).

______. Elements of Color in Professional Motion Pictures. Foreword by J.P. Weiss, Chairman of the SMPTE Color Committee; Prepared by a Special Committee of the SMPTE; Preface by Wilton R. Holm, Committee Chairman. New York: SMPTE, 1957 [reprinted, 1967], 104pp. illus.

Contents: Foreword, p. 3; Preface, p. 4; 1. Introduction to 1967 Reprint, p. 6.

In this Second printing. . . no revisions have been made in either the text or illustrations. . . .

Fortunately, a large portion of the book is so fundamental that few chapters are out of date. . . .

. . . . The information contained in Chapters 4,10 and 11 needs revision. In those chapters, asterisks signal those portions of the text that are out of date and do not apply to current practice. . . .

An Eastman Kodak leaflet "Motion Picture Prints from Color Originals" No. H-25, dated 9-67 accompaning this book describes the properties of various color printing systems using Kodak products, but these systems are often applicable to materials of other manufacturers as well--July, 1967.

Society of Photographic Scientists and Engineers. SPSE Handbook of Photographic Science and Engineering. Edited by Woodlief Thomas Jr., A Wiley-Interscience Publication. New York: John Wiley and Sons, 1973. 1416pp.

An extensive reference work containing a source of numerical constants, formulas, definitions and other data not customarily memorized. The material is directed to meet the needs of three related groups of Photographic Scientists and Engineers. 1. Invent, design, develop or engineer photographic systems and components--films, processes, equipment; 2. Uses

Photography as a scientific or engineering tool in almost any field of endeavour; 3. Scientists--Chemists, Physicists, or Engineers--Chemical, Mechanical or Electrical--The Photographic Industry. A section is also included "Guide to Photographic Information for Additional Materials.

Souto, Mario Raimondo. The Technique of the Motion Picture Camera. Revised and enlarged edition. New York: Hastings House Publishers, Inc., 1967. 322pp. illus.

Series: Library of Communication Techniques.
A comprehensive study of the modern film camera; includes design, operation, maintenance, and filming technique.

Spencer, D. A. Editor-in-Chief. Progress in Photography; 1940-1950. Volume One of an International Record. New York and London: The Focal Press, Ltd., 1951. 463pp. illus.

An international effort to provide a complete coverage of the progress in the science and technology of photography from 1940-1950. Each section is authored by a recognized authority in the field and is well documented with illustrations, literature and patent references.

The application of photography to a variety of optical, astronomical, physical and chemical problems and the unusual and specialized development in high-speed, color, special emulsions, and similar subjects will make this volume a most useful reference to research workers and professional photographers.

Contents: Section 1. Photographic Equipment and Practice; 2. The Photographic Process; 3. Recording Documents; 4. Recording Transient Events; Flash Photography by G. A. Jones, p. 191, Photography of Motion, p. 200; 6. Recording Sound; 7. Recording Color; 8. Recording Invisible Radiation; Ultra-Violet and Infra-red Photography by Walter Clark, p. 259; 9. Recording Evidence; 10. The Camera as a Tool of Research, pp. 301-362; Micrography, J.H. Tabor, p. 301, Photography in Astronomy. D. R. Barker, p. 310, X-Ray Crystal Analysis. H.P. Rooksby, p. 312; Photo-elastic Stress Analysis. p. 315, Electron Diffraction, p. 318, Schlieren Photography. p. 323, Phase Contrast Microscope. p. 331, Air Photography Applied to Archeology, Geology and Geography. p. 333, Air Photography in Forestry and Ecology, Medical Photography, Miniature Photography, Cine Radiography and Endoscopic PHotography; 11. The Camera as an Industryal Tool. p. 363; 12. The Camera as Historian. p. 393; 13. The Camera as Teacher. p. 401; 14. Standardisation and Legal Aspects. p. 415; 15. Business and Scope of Photography. p. 431; 16. Photographic Organizations. p. 447; 17. Appendix. Periodicals Cited in Literature References. p. 451. Index. p. 451

______. Progress in Photography; 1951-1954. Volume Two of an International Record. New York and London: The Focal Press, Ltd., 1954. 336pp. illus.

Contents: Section 1. Photographic Equipment. p. 13; 2. Photographic Theory and Materials. p. 59; 3. Colour Photography. p. 115; 4. Photographic Processing. p. 137; 5. Cinematography. p. 167; 6. Special Techniques: High-Speed Photography--Kenneth Shaftan, p. 201. (224 references); Photomicrography. p. 230. Oscar W. Richards. (37 references); Ultra-Violet Photomicrography and Metallography; Phase Contrast and Interference Microscopy; Stereoscopic PHotography; 7. Special Applications. p. 257; 8. Radiography and Diffraction; 9. Photographic Business and Industry. p. 295; 10. Photographic Organizations and Standards. p. 317; 11. Appendix--Periodicals cited in literature references. p. 325; Errata in Volume of Progress in Photography. p. 329. Index. p. 330.

______. Progress in Photography; 1955-1958. Volume Three of an International Record. London: The Focal Press, Ltd.; New York: The MacMillan Co., 1959. 168pp. illus.

Contents: Section 1. Practice and Techniques; 2. Photographic Theory and Materials; 3. Business; 4. Literature; 5. Applications; 6. Appendix [Periodicals Cited] 1000 references. Includes the following materials related to the Soviet film industry. K.V. Chibisov. Russian Work on the Theory of Photographic Emulsions." pp. 72-87. (83 references); V.I. Sheberstov. Russian Literature on the Photographic Process. 1. General: 2. Monographs and Teaching Aids; 3. Theory of the Preparation of Photographic Light-Sensitive Layers, Optical Sensitization; 4. The Photo-Chemistry of Photographic Emulsion Layers and the Theory of the Latent Image; 5. Photographic Development and other Chemical Photographic Processes. pp. 122-134. (200 references).

______. The Focal Dictionary of Photographic Technologies. London: The Focal Press, Ltd., 1973. 725pp.

An authoritative reference work containing specialized terms for photographic sciences, technology and applications to particular areas of photography.

Spottiswoode, Raymond., General editor. The Focal Encyclopedia of Film and Television: Techniques. New York: Hastings House Publishers, Inc., 1969. 1124pp. illus.

A comprehensive and self-contained volume concentrating on the tools of film and television making.

Stueper, Josef. Die photographische kamera. ("The Photographic Camera"). Vol. II. Vienna: Springer Verlag, 1962. 530pp. + xixpp.

From the series Die wissenschafliche und angewandte photographie. ("The Scientific and Applied Photography"), Vol. I, III, and V previously published cover the subjects of Photographic Lenses (J. Fluegge), Motion Picture Cameras (H. Weise), The Technique of Negative and Positive Processes (E. Mutter).

Vol. II starts with a short review of the main types of cameras on the market, and proceeds to discuss the components. (1). Lenses; (2). Shutters; (3). Means for Focusing, Aiming and Framing, i.e., rangefinders, viewfinders and design elements of the camera for ascertaining the best focus and framing; (4). Means for Holding and Guiding Light Sensitive Material (Glass Plates, Film Magazines, Cassettes, Transport Mechanisms, Formats and Film Sizes); (5). The Camera Body and Manufacturing Techniques; (6). Means for Determining the Exposure including Basic Concept of Photometry, Photo Cells and Exposure Meters, Integrating the Meter in the Camera, Automatic Coupling of Meter Diaphram and Shutter, and Accessories. Several Special Cameras and Equipment are Briefly Discussed. Contains an Extensive Bibliography of 624 titles. A List of Technical Journals; Applicable German Standards; Author and Subject Indexes.

Sturge, John M., ed. Neblette's Handbook of Photography and Reprography: Materials and Processes. Seventh edition. New York: Van Nostrand Reinhold Co., 1976. 592pp. illus.

Comprehensive reference survey of photographic technology; Essential aspects of the optics, chemistry, and physics of processes as well as the manufacture and preparation of materials. Includes a definitive account of the Polaroid Process (up to the new SX-70 System) with material by Dr. Edwin Land, and also includes coverage on latest xerographic processes and systems.

Sussman, Aaron. The Amateur Photographer's Handbook. 8th ed. New York: Thomas Y. Crowell Co., Inc., 1973. 562pp. illus.

Discusses new equipment, materials and techniques. Includes information on TTL (Through-the-Lens) metering systems, focused flashcubes, flash without batteries, multicoated lenses, special developers, etc. Glossary and Comprehensive index is included.

The Academy of the Hebrew Langauge Specialized Dictionaries XII. Dictionaries of the Central Committee for Technical Terminology IX. Dictionary of Terms in Photography: Hebrew--English--French--German. Haifa: The Academy of the Hebrew Language and Technion--Israel Institute of Technology, 5726 [1966]. [From right to left--English, 23pp; French, 22pp; Deutsch, 20pp. From Left to Right, Hebrew, 123pp].

The Focal Encylopedia of Photography. In Two Volumes. Fully Revised Edition. Edited by A. Kraszna-Krausz (Chairman of the Editorial Board), et al. London: Focal Press, Ltd., 1965. 1,699pp. illus.

Thomas, Geoffry Gladstone. Engineering Metrology. A Halsted Press Book. New York: John Wiley & Sons, Inc., 1974. 420pp. diagrams.

An up-to-date analysis of the science of fine measurement its application to engineering design and manufacture. Concerned with the fundamental standards and techniques of measurement and with the scientific principles of the instrumentation involved. Contents: Interferometry; The Laser; Holography; Diffraction Gratings and Moire Fringes; Length and Diameter; Angle; Linearity and Flatness; Surface Texture; Roundness; Index.

Time-Life Books, eds. Life Library of Photography. A 17 Volume Series. Chicago, Ill.: Time Life Books.

The following volumes are of particular value for Photography in Scientific Research.

The Camera. 1970. illus. Examines modern cameras and lenses and uses to which they are best suited. Presents technical and aesthetic advice on improving picture quality and briefly discusses the history of photography.

Light and Film. 1970. illus. An in-depth examination of the effect of light on films--discusses artificial and natural lighting and how to calculate exposure.

Color. 1970. illus. How color films work; How to use them, and developing procedures.

Photography as a Tool. 1970. illus. Scientific and industrial photography and use of the cameras in astronomy and medicine as well.

Special Problems. 1971. illus. The difficulties encountered by photographers, challenges of shooting under extreme conditions of heat and cold. How to exploit problem areas for increased picture quality.

Photographing Nature. 1971. illus. The natural world--lesson on how to photograph plants, flowers, insects and birds.

Frontiers of Photography. 1972. illus. The future of photography--discusses cameras, lenses, films, processes (Including 3-dimensional holography).

Townsend, Derek. Photography and Cinematography: A Four Language Illustrated Dictionary and Glossary of Terms. International Glossary Series. (English, French, Italian and German). London: Alvin Redman Ltd., 1964. 178pp. illus.

Tupholme, C.H.S. Photography for Engineers. London: Faber and Faber Ltd., 1945. illus.

Covers a few specific applications under each of the eight chapters. Each application was selected because it is typical of many with slight variations in technique. Ample references are included as well as a bibliography for further investigation.

Contents: Foreword. p. v; Chapter 1. Photography of Drawings and Documents; 2. Photography in the Laboratory; 3. High-Speed Photography; 4. Radiography; 5. X-Ray and Electron Diffraction and Microradiography; 6. Processing and Storing X-Ray Material; 7. Infra-red Photography; 8. Instructional Motion Pictures. Index.

U.S. Air Force. Department of Aerospace Photography. Photo Sciences Branch. Optical Instrumentation Specialist/Technician. 235X0. In 6 Volumes. [Denver, Colorado]: Lowry Air Force Base, Technical Training Center.

Volume 1. Optical Recording Components and Processes. iv + [340]pp. illus.
Chapter 1. Introduction to Optical Instrumention.
Chapter 2. Optical Component Systems
Chapter 3. Photosensitive Material and Processes.
Chapter 4. Illumanents.
Includes a short bibliography of 4 references.

Volume 2. The Recording Instrument. iv + [83]pp. illus.
Chapter 1. Single-Exposure, Framing Devices.
Chapter 2. Multiple Exposure, Framing Devices.
Chapter 3. Continuous-Writing, Multiple Framing Devices.
Chapter 4. Transitory-Writing, Multiple Framing Devices.
Chapter 5. Intermittent-Writing, Multiple Framing Devices.
Chapter 6. Streak Recording Devices.

Volume 3. Instrument Orientation Systems and Analysis Procedures. [107]pp. illus.
Chapter 1. Mechanical and Electronic Component Systems.
Chapter 2. Data Processing.

Volume 4. Specialized Techniques and Devices. [107]pp. illus.

This volume is subdivided into ten chapters dealing in order with--Shadowgraph techniques, Schlieren Techniques, Interferometry, Scope Recording, Underwater, Cine Theodolites, Synchro-Ballistic Techniques, Telescopy, Topographic Measurements and Television.

Volume 5. Applications. [69]pp. illus.
Contents: Chapter 1. Mechanical Analysis; 2. Detonation and Explosive Studies; 3. Ballistic Studies; 4. Sled Track Recording; 5. Flame and Combustion Studies; 6. Liquid Flow Studies; 7. Gas Flow Studies; 8. Stress, Shock and Vibration; 9. Photography of Living Subjects.

Volume 6. Aerial Instrumentation. [32]pp. illus.
Contents: Applied Aerial Photographic Techniques; 2. Atmospheric Studies; 3. Data-Panel Recording; 4. Spacecraft Installation.

U.S. Naval Ordnance Test Station, Inyokern, Test Department. Metric Photographic Instrumentation Handbook. China Lake, Calif.: U.S. Naval Ordnance Test Station, 1952. [With additional material added during 1959].

Valyus, N.A. Stereoscopy. London: Focal Press, Ltd., 1966. 426pp. [Translated from Russian].

Vasil'chenko, N.V., et al. Nemetsko-Russkiy Slovar' po Optike. ("German-Russian Dictionary on Optics"). Moscow: Russkiy yazyk ("Russian Language"), 1975. 488pp. (Contains Approximately 20,000 Terms). Available from Victor Kamkin Inc., Bookstore, 12224 Parklawn Dr., Rockville, Md., 20852. Cat. No. 30, 1976, Item 73. $5.25.

Walter, Gerard O., and Shultz, Theodore S. The Miniature Camera--A Major Research Tool. New York: Standard Camera Corp., 1957. 57pp. illus.

Wheeler, Leslie J. Principles of Cinematography: A Handbook of Motion Picture Technology. London: Fountain Press Ltd., 1953. [Fourth edition, 1969. 440pp. illus.].

The mechanics of cinematography; theory, purpose, equipment design, sound recording and reproduction techniques as applied to cinematography. Bibliography.

Youngblood, Gene. Expanded Cinema. Introduction by R. Buckminster Fuller. New York: E.P. Dutton and Co., Inc., 1970. 432pp. illus.

Contents: Part 1. The Audience and the Myths of Entertainment; 2. Synaesthetic Cinema; The End of Drama; 3. Toward Cosmic COnsciousness; 4. Cibernetic Cinema and Computer Films; 5. Television as a Creative Medium; 6. Intermedia; 7. Holographic Cinema: A New World.

Zworykin, Vladimir K., and Ramberg, E.G. Photoelectricity and its Application. Second Printing. New York: John Wiley and Sons, Inc., 1950. 494pp. illus.

The purpose of this book is to familiarize the reader with the properties, preparation and use of photoelectric devices. The emphasis is on the practical aspects of the subject. Theory is presented largely for its mnemonic value. Mathematical developments are restricted to footnotes so as not to interrupt the readers train of thought.

The first eleven chapters deal with the principles and preparation of photosensitive devices. The remainder of the book with their applications. A brief account of earlier developments in the field of photoelectricity is followed by a discussion of light sources and the basic principles of the photoemissive effect.

Contents:

CHAPTER VI

SCIENCE AND TECHNOLOGY: ASTRONOMY, CLOSE-UP PHOTOGRAPHY, INFRARED PHOTOGRAPHY, PHOTOMICROGRAPHY, PHOTOMACROGRAPHY, SCIENTIFIC RESEARCH, SYMPOSIUMS, TECHNIQUES IN BIOLOGY AND MEDICINE , AND TELEVISION

CHAPTER VI

SCIENCE AND TECHNOLOGY: ASTRONOMY, CLOSE-UP PHOTOGRAPHY INFRARED PHOTOGRAPHY, PHOTOMICROGRAPHY, PHOTOMACROGRAPHY SCIENTIFIC RESEARCH, SYMPOSIUMS, TECHNIQUES IN BIOLOGY AND MEDICINE, AND TELEVISION

Abramenko, Aleksandr Nikolyaevich., et al. Televizionnaya astronomiya. ("Television Astronomy"). Moscow: Izd-vo, "Nauka," 1974. 296pp.

Examines problems of the use of highly sensitive television systems for goals of terrestrial astronomy. Features of Television Apparatuses, used both for obtaining direct pictures of the sky and for recording spectra of celestial objects were collected in detail. Much attention was paid to the use of a television method for the search and study of objects with ultrashort periodic changes of brightness. The method of photometric treatment of television pictures of stars and planets is described and the precision of their brightness is evaluated.

Contents: From the Editor; Introduction. Part I. Astronomical Television Apparatus. Chapter 1. Television Method of Astronomical Observations; 2. Transmitting Television Tubes; 3. Regimes of Operation of an Image Orthicon and Electron Optic Transformers during their use in Astronomical Television; 4. Astronomical Television Apparatus with an Image Orthicon. Main Blocks and Units. 5. Astronomical Television Apparatus. Auxiliary Blocks; 6. Specialized Astronomical Television Apparatuses; 7. Characteristics of Astronomical Television Apparatuses. Part II. Comparison of Characteristics of Ideal and Real Light Receivers. Chapter 8. Penetrating Capacity of Telescopes with Ideal and Quasi-Ideal Radiation Receivers; 9. Penetrating Capacity of Telescopes with Highly Sensitive Image Orthicons; 10. Contrast Sensitivity of Different Light Receivers. Part III. Use of Television Technology for Astronomical Observations. Chapter 11. Photometry of Stars; 12. Observations of Planets and Nebulas; 13. Search and Study of Objects with Rapid Changes of Brightness; 14. Observations of Artificial Space Objects, Small Planets, Comets and Meteors; 15. Automation of the Process of Obtaining and Treatment of observational Data. Literature, p. 283.

Allen, R. M. Photomicrography. Second edition. New York: Van Nostrand, 1958. 441pp.

Balkanski, Minko, and Lallemand, P., eds. Photonics. Paris: Gauthier-Villars, 1975. 411pp. illus.

A compilation of 21 papers [14 in English and 7 in French] dealing with optical communications, integrated optics and semi-conductor lasers previously presented at a conference in Cadarache France (June 27-29, 1974) by the French General Delegation for Scientific and Technical Research. Also includes several papers sponsored during 1973-1974. Topics include: Low Loss Optical Fibers, Photodetectors, Holographic Storage, Optical Processing, Magneto-Optical Effects, Photon Statistics and Coupling of Optical Devices and Waveguides.

Blaker, Alfred A. Field Photography. [Beginning and Advanced Techniques]. San Francisco: W.H. Freeman & Co., 1976. 451pp. illus.

According to Blaker the purpose of this text is to "help interested persons to improve the quality of the photographs they may need, and to enable them to take photographs under unusually difficult and unfamiliar curcumstances in order to illustrate factual presentations more effectively.

Part I: Basic introduction to photography, includes simplified diagrams of equipment and materials necessary for general and field photography. Section II "Basic Photography," reviews general techniques, deals iith comprehension and composition of the picture, exposure factors, filters and darkroom procedures. Section III, final segment is field tecbnique oriented, deals with focal length variation techniques, close-ups and photomacrography, stereo photography and flash applications. Considers climatic problems, covering a wide range from precipitation and wind to extremes of climatic conditions and the problems of static.

______. Photography for Scientific Publication: A Handbook. San Francisco: W.H. Freeman & Co., 1965. 158pp. illus.

Macro and extreme close-up photography. Excellent diagrams of lighting and specimen placement. Compares color and black-and-white photography.

Bracegirdle, Brian. Photography as Illustration; The Use of the Camera for Books and Reports. New York: A.S. Barnes & Co., Inc., 1972. 247pp. illus.

Burton, Alexis L., ed. Cinematographic Techniques in Biology and Medicine. New York: Academic Press, Inc., 1971. 394pp. illus.

Contents: Part One. The Motion Picture Film; The Film, Classification of Films, Handling, Storing and Processing Film, The Film Laboratory. Part Two. The Motion Picture

Camera; Principles and Definitions, Descriptions of some Commercial Cameras. Part Three. Filming; Lighting, Exposure Determination and Exposure Meters, Synchronization of the Motion Picture Camera with External Devices, Time-Lapse Cinematography, High-Speed Cinematography of the Microcirculation, Adaptation of the Motion Picture Camera to Extreme Close-up, Adaptation of the Motion Picture Camera to the Microscope, Oscilloscope Camera and Continuous Recording, Cinematography in Gross Anatomy Teaching, Cineradiography--X-Ray Cinematography, Identification of Films: Titles, Simple Animation. Part Four. Editing; Editing, Sound Recording, Analyzing Films. Part Five. Projection: General Principles, Description of Some Commercial Motion Picture Projectors. Part Six. Television in Biology and Medicine. Foreword. Introduction. The Television Camera, The Film Chain, The Video Tape Machine. Index.

Dainty, J. C., and Shaw, R. Image Science; Principles, Analysis and Evaluation of Photographic-Type Imaging Processes. New York: Academic Press, Inc., 1975. 420pp.

An advanced undergraduate or graduate text on this subject. This book provides basic theories for scientists entering this field.

Contents: Spatially-Recorded Images: Some Fundamental Statistical Limitations. Input/Output Relationships for Conventional Photographic Processes: Experimental Observables. Output/Input Relationships for Conventional Photographic Processes: Analytical Models. Quantum Sensitivity and Ultimate Photographic Sensitivity. Detective Quantum Efficiency, Signal-to-Noise Ratio, and the Noise-Equivalent Number of Quanta. Fourier Transforms, and the Analysis of Image Resolution and Noise. The Modulation Transfer Function. Image Noise Analysis and the Wiener Spectrum. Microdensitometry. Image Assessment by Information Theory. References. Exercises. Appendix. Author Index. Subject Index.

Dalton, Stephen. Borne on the Wind. New York: Reader's Digest Press [Distributed by E.P. Dutton and Co., Inc.], 1975. 160pp. illus [64pp., in Color].

A remarkable series of close-up photographs in color and black-and-white of insects in flight with maximum sharpness and detail. The author explains how this challenge to photograph the wingbeat of an insect in free flight was met by developing a camera shutter, considerably faster than commercially available models and by constructing an electronic flash of great brilliance that can be triggered within one-millionth of a second on an insect's breaking a beam of light. Dalton concludes his book with a 16 page section "The Photographer at Work."

Eastman Kodak Company. Applied Infrared Photography. Rev. ed. Kodak Publication No. M-28 [Minor Revision 5-73] Rochester, New York: Eastman Kodak Co., 1973. 89pp. illus.

Outdoor and indoor techniques for photography by infrared radiation. The purposes of the various methods and the procedures involved are described. Contents Include: Understanding Infrared Photography, Infrared Photography Outdoors, Equipment and Materials, Negative and Print Factors, Indoor Lighting and Exposures, Color Plates, Specific Copying Applications, Specific Specimen Applications, Specialized Indoor Techniques, References.

_______. Basic Infrared and Ultraviolet-Fluorescence Photography. Publication No. AM-6 Rochester, New York: Eastman Kodak Co., 1976. 19pp. illus.

_______. Basic Scientific Photography. A Kodak Scientific Data Book, No. N-9. [Minor Revision 4-73]. Rochester, New York: Eastman Kodak Co., 1973, 40pp. illus.

The main purpose of this book is to acquaint students and teachers at all academic levels with the ways in which they can gain the benefit of photography in their study and teaching programs and in their research projects. . . .

. . . .

The fields covered are those in the natural sciences, in archeology and in biomedicine. Black-and-white, color, copying, close-up, photomacrographic, photomicrographic, ultra-violet, and infrared techniques are all dealt with. . . .

Contents: Field Photography. Laboratory Photography. Optical and Color Factors. Lighting. Copying. Special Techniques: Medical Photography. Infrared Photography. Ultraviolet Photography. Photomacrography. Photomicrography.

_______. CinePhotomicrography. A Kodak Scientific Publication, No. N-2. Rochester, New York: Eastman Kodak Co., 1970. 40pp. illus.

Cinephotomicrography (also called Cinemicrography), involves the adaptation of a motion-picture camera to a compound microscope in order to record images of moving microscopic objects. . . .

. . . .

The great advantage of the motion picture in photomicrography. . . is its ability to record motion. All live microscopic specimens manifest some movement--such as cell division, search for food and growth. . . . (p. 2).

Contents include: Cinephotomicrography, Apparatus, Camera Techniques, Illunination and Light Sources, Films, Filters, Exposure, Types of Microscopes, Applications, etc.

_______. Close-Up Photography and Photomacrography. Vol. 1 Close-up Photography. A Kodak Publication No. N-12 A. Rochester, New York: Eastman Kodak Co., 1974. 88pp. illus.

_______. Close-Up Photography and Photomacrography. Vol. II. Photomacrography. A Kodak Publication No. N-12 B. Rochester, New York: Eastman Kodak Co., 1974. 88pp. illus.

Two working manuals by Lou Gibson which contain a full treatment of the equipment, techniques and materials that may be used. Working curves can help photographers select correct optical and mechanical settings for magnification, f/number and resolution, minimizing time-consuming and trial and error attempts to sovle cases in close-up and photomacrography.

_______. Kodak Filters for Scientific and Technical Uses. Updated Revision, Kodak Publication No. P-315. Rochester, New York: Eastman Kodak Co., 1976. 89pp.

_______. Kodak Plates and Film for Scientific Photography. No. P-315. Rochester, New York: Eastman Kodak Co., 1974.

Comprehensive scientific photography data book with extensive information about properties of a selection of Kodak plates and films for scientific and technical photo applications This book is divided into two main sections: A Text Section and a Data Section.

Text Section: Introduces the principal photographic parameters of photographic materials. Contains a review of image properties of exposed and processed materials which may have a direct bearing on the proper interpretation on photographically recording information. Material on photographic processing, glass specifications and recommendations for the proper handling and storage of photographic products are also included in the text section.

Data Section: Contains tabular data and graphic presentations of the emulsion and image-structure characteristics of the special products covered in this publication.

_______. Photography Through the Microscope. No. P-2. Rochester, N.Y.: Eastman Kodak Co., 1974. 76pp. illus. refs.

_______. Thermal Photography. P-570. Rochester, New York: Eastman Kodak Co., 1976. 5pp. illus.

_______. Ultraviolet and Fluorescence Photography. Kodak Technical Publication No, M-27. Rochester, New York: Eastman Kodak Co., 1972. 32pp. illus.

I. Ultraviolet Photography, Ultraviolet Radiation; Photographic Considerations; Specific Applications. II. Fluorescence Photography. Luminescence, Excitation Sources; Photographic Technique, Specific Applications. Appendix.

Engel, C. E., ed. Photography for the Scientist. New York: Academic Press, Inc., 1968. 632pp.

A detail examination for the uses of photography and television techniques in science--includes a wide range of application of both techniques, from theoretical considerations to more specific practical details. The book is intended for the scientist using photography as a research tool or as a means for presenting data.

Contents: H. Baines. The Photographic Process; M.G. Fisher. Sensitive Materials; P. Rolls. Photographic Optics; L.H. Verbeek. Lighting Equipment; R.A. Kolvoord. Processing; K.B. Atkinson, and I. Newton. Photogrammetry; H.L. Gibson. Infra-red Recording; P. Hansell. Ultraviolet and Fluorescence Recording; H.U. Richter. Underwater Photography; H.H.Heunert. Close-up and Photomacrography of Live Subjects; W.L.M. Martinsen. Photography of Specimens; A.S.G. Curtis. Quantitatve Photomicrography; R. Ollcrenshaw. Photographic Copying; B. Shackel and G. R. Watson. Closed Circuit Television. Author Index, Subject Index.

Ettlinger, D. M. Turner., ed. Natural History Photography. New York: Academic Press, A Subsidiary of Harcourt Brace Jovanovich, Publishers, 1974. xxxvii + 396pp. 64 plates.

Discusses photographic techniques for a wide range of subjects from big game to insects, caves and plants. Should be of great interest to all photographers, as well as to biologists and naturalists who use photography as a means of recording their subjects. Techniques of particular interest include high-speed flash, stereo-photography, the use of play-back tape, and cave photography.

Gibson, H. Lou. Defining Power in Photomacrography. FPSA Board of Registry of the Biological Photographic Association Inc., Publication. 31pp. [illustrated with photographs and line graphs].

Giebelhausen, Joachim. Photography in Industry. English edition by E.F. Linssen. Publisher Nikolaus Karpf. Munich: Verlag Grossbild-Technik GMBH, 1967. 250pp. illus.

Gilmore, Clarence Percy. The Unseen Universe: Photographs from the Scanning Electron Microscope. New York: Schocken Books, Inc., 1974. 189pp. illus.

A compilation of photographs showing the visual imagery of the unseen universe through the use of a scanning electron microscope.

Haine, Michael E., and Cosslett, Vernon E. The Electron Microscope: The Present State of the Art. New York: Interscience Publishers, Inc., 1961. 282pp. illus.

Contents: Optical Properties of Electron Microscope Lenses; Electron Waves; Coherence and Wave Propagation; Theoretical Limitations to Resolving Power; Image Contrast, Practical Factors Limiting Performance, The Electron Gun Characteristics, Observation and Recording of Electron Image, Design Considerations, Related Techniques and Instruments, Specimen Techniques and Applications. Indexes.

Hayat, M.S., ed. Principles and Techniques of Electron Microscopy: Biological Applications. Volume 5. New York: Van Nostrand Reinhold, 1975. 250pp.

Holder, D.W., and North, R.J. Schlieren Methods. [GB National Physical Laboratory, Notes on Applied Science, No. 31]. London: H.M. Stationary Office, 1963. 106pp. illus.

Hudson, Richard D. Jr. Infrared System Engineering. New York: John Wiley & Sons, Inc., 1969. 642pp. illus.

This book is written for those who design, build, test, or use infrared equipment to solve problems that occur in the military, industrial, medical and scientific fields. Pt. I. The Elements of the Infrared System. History of the Development of the Infrared Portion of the Electromagnetic Spectrum, the System Engineering Process and characteristics of the successful system engineer. Chapters 2-12 delve deeply into the engineering aspects of the elements that comprise the infrared system. Chapter 13 returns to the systems viewpoint and Chapter 14 gives the reader an insight into the development of an infrared search system for use in commercial jet transports.
Pt. II. The Application of Infrared Techniques.

_______., and Hudson, Jacqueline W., eds. Infrared Detectors. Stroudsburg, Pa.: Dowden, Hutchenson & Ross Inc., Dist. by Halsted Press, 1975. 392pp.

A collection of papers from 1946-1973. Topics covered include infrared-detectir cgaracterustucsm detection fundamentals, photon detectors, thermal detectors, cooling techniques and performance limits of detectors.

International Congress of Photographic Science. Photographic Science. Symposium: Zürich, 1961. Ed. by W.F. Berg. Intro. by J. Eggert. London: The Focal Press, Ltd., 1963. 456pp.

Contents: Photographic Latent Image; Dye Sensitization; Emulsion Binding Agents; Emulsion Research; Photographic Development; Photographic Processes Excluding Silver Compounds. Post Script: Personal Reactions. Participants; Sponsors. Indexes.

_______. Photographic Science. Symposium: Torino, 1963. edited by G. Semerano, and U. Mazzucato. London and New York: The Focal Press, Ltd., 1965. 248pp. illus.

_______. Photographic Science. Symposium: Paris, 1965. edited by J. Pouradier. The Focal Library. London and New York: The Focal Press, Ltd., 1967. 456pp. illus.

Topics include: "Structure and Properties of Light-Sensitive Crystals," on which there were 20 papers; "Properties of Photographic Gelatins," (six papers), and "Spectral Sensitization," (15 papers). A general discussion followed the session of spectral sensitization, and is well presented. The next section "Action of Light-Luminescence, Phosphorescence, Traps and Latent Image," (consisted of 32 papers). It is followed by a section on "Development, Fixation and Storage," (comprising 20 papers). A final section on "Image Structure," (has 29 papers).

_______. Photographic Science. Symposium: Tokyo, 1967. edited by S. Kikuchi. The Photographic Image: Formation and Structure. The Invited Papers Presented at the ICPS Tokyo, 1967. London and New York: The Focal Press, Ltd., 1970. 210pp.

_______. Photographic Science. Symposium: Moscow, 1970. [July 29-August 5, 1970]. 3 Volumes. Moscow: International Congress of Photographic Science, 1970.

Contains 177 short papers in three volumes. Volume 1--Section A & B [1,348pp], covers the Nature of Photographic Sensitivity, Photographic Emulsion, Sensitization and Gelatine. Volume 2--Sections C & D covers Chemical Photographic Processing and Structural Characteristics of the Photographic Image. [218pp]. Volume 3 [276pp] is devoted to Non-silver and Unconventional Photographic Processes.

_______. Photographic Science. Symposium: Dresden, 1974. [September 1-8, 1974]. Dresden: German Democratic Republic, 1974.

Topics: 1. Nature of Photographic Sensitivity; 2. Photographic Emulsions, Sensitization, Gelatin; 3. Processing of Photographic Layers; 4. Structural Characteristics of the Photographic Image; 5. Non-Silver Halide Materials and Unconventional Photographic Processes; 6. Magnetic Video Recording.

Ivanitskays, M. A., et al. Rentgenokinematografiya v diagnostike zabolevaniy serdtsa. ("X-Ray Cinematography in Diagnosis of Heart Diseases"). Trans. of unidentified Russian Language Article 1971 (26 June 1972). Report No. USAMIIA-K-2168. AD A028 272/3GA. Springfield, Va.: NTIS, 1972. 213pp.

Monograph dealing with the experience of a broad use of the new method of heart exploration--roentgenocinematography.

Katasev, L.A. Fotograficheskie metody meteornoi astronomii. ("Photographic Methods in Meteor Astronomy"). Moscow: Izd-vo, "Tekhniko-teoreticheskoi literatury," 1957. [Published for NASA and National Science Foundation, Washington, D.C. Accession No. NASA TTF-142 OTS 64-11021; Jeruslaem, Israel: Program for Scientific Translations, 1964. 114pp. illus.].

Kriksunov, L.Z. Pribory nochnogo videniia. ("Night Vision Instruments"). Kiev: Izd-vo, "Tekhnika," 1975. 216pp.

Structure and principles of operation for a wide range of night vision devices, including electrooptic converters, radiometers, thermal direction finders and thermal imagers.

Krivosheev, M.I., ed. Televizionnye metody i ustroistva otobrazheniia informatsii. ("Television Methods and Devices for Data Display"). Moscow: Izd-vo, Sovetskoe Radio, 1975. 240pp. (In Russian).

Collected papers: Pt I. devoted to the design principles for TV data display systems; Pt II. to the formation of TV data display signals; Pt. III. to the description of TV data display systems and devices; and Pt. IV. to data display using TV methods but without cathode ray tubes.

Kudryashov, Nikolai N. Kinos"yemka v nauke i tekhnike. Vvedeniye v tekhniki nauchno-issledovatel'skoy kinos"yemk. ("Motion Picture Photography in Science and Technology. Introduction to the Techniques of Scientific-Research Motion Picture Photography"). Under the editorial guidance of Ye. M. Goldovskiy. Moscow: Gos. Izd-vo, "Iskusstvo," 1960. 334pp. illus.

Characteristics and construction of basic photographic equipment, provides an understanding of the processes, techniques and applications in scientific and technical photography. Discusses various modes and methods of motion picture photography such as infra-red, ultra-violet light sources, and polarized light combined with motion picture equipment. Delves into photography with a microscope, telephoto optics, x-ray, aerial and underwater.

Levitin, I.B. Fotografiya v infrakrasnyk luchakh. ("Infrared Photography"). Moscow: Izd-vo, "Voyenizdat," 1961. 192pp. illus. [Available in English as Accession No. AD 663 365] Springfield, Va.: NTIS, 151pp.

Linder, Raymon. Data Aid; Photo Instrumentation. San Jose, Calif.: Girl Friday Letter Shop. 204pp.

An aid to photo-instrumentation personnel who have the responsibility for recording and reducing data. Contents: Introduction. Basic Cinsiderations; Simple Motion; Acceleration; Forces; Vector Addition; Film Readout Equipment; Determination of Time Intervals; Determination of Linear Displacements; Roll Measurements; Attitude; Image and Time Resolution; Rotary Prism

vs Intermittent Cameras; Calculation accuracy; Accuracy Statements; Light; Shadowgraph; Schlieren; Streak Records; Elliptical Relationships; C.G. and Centerline Error; Types of Data Presentation; Statistics; Angle Relationships; Conversion Factors and Constants; Exposure Times; Depth of Field Graphs; Field of View; Focal Length; Film Dimensions; Trignometric Functions; Potpourii. (Numerous Equations and Facts for Ready Reference).

Lloyd, J. Michael Thermal Imaging Systems, edited by William L. Wolfe, New York: Plenum Press, 1975. 456pp. illus.

An introduction to the technology of thermal imaging and a compendium of the conventions which form the basis of current FLIR (Forward Looking Infrared) practice.

Loveland, Roger P. Photomicrography: A Comprehensive Treatise, 2 Vols. New York: John Wiley & Sons, Inc., 1970. 1063 pp.

Volume 1. General Survey--The Simple Microscope; General Optical Principles; The Compound Microscope; Apparatus (Except Lamps); Photomicrography by Incident Illumination; Low Power Photomicrography (Photomacrography); Illumination (Optics and Photometry); Lamps; Quality of Illumination; Image Contrast; Eyepiece and Roll Film Cameras in Photomicrography. Appendices.

Volume 2. Special Methods of Illumination; Flash Photomicrography; Use of the Photographic Spectrum; Photographic Principles; Selection of Photomicrographic Materials; Special Problems and Advantages in Color Photomicrography; Flourescence Micrography; Cinemicrography. Appendices.

Mannheim, L.A., ed. Perspective World Report 1966-69 of the Photographic Industries, Technologies and Science. London and New York: The Focal Press Ltd., 1968.

Contents: I. The Photographic Industry and Trade; II. The Photographic Product; III. Applied Photography; IV. Photographic Research and Theory; V. Publications, Associations and Conferences. (Books on Scientific and Technical Photography by D.H.O. John, pp. 383-391). Index, p. 423.

Marey, Etienne Jules. (1830-1904). Animal Mechanism; A Treatise on Terrestrial and Aerial Locomotion. 3rd ed. London: K. Paul, Trench, 1883, xvi, 283 pp. illus. (International Scientific Series, V. II).

______. Animal Mechanism; A Treatise on Terrestrial and Aerial Locomotion. (With One Hundred and Seventeen Illustrations, Drawn and Engraved under the Direction of the Author. 2nd ed. London: H.S. King & Co., 1874. xvi, 283 pp. illus.

______. La Chronophotographie. Paris: Gauthier-Villars, 1899. 40pp. illus.

______. Le movement. ("Movement"). Paris: G. Masson, 1894.

______. Movement. Translated by Eric Pritchard. with two hundred illustrations. London: W.Heinemann, 1895. xv, 323pp. illus.

Michaelis, Anthony R. Research Films in Biology, Anthropology, Psychology and Medicine. Foreword by Robert Watson-Watt. New York: Academic Press, Inc., 1955. 490pp. illus.

From the Preface: Research films are motion pictures made in the laboratory, or during the course of field work, which aid directly in the discovery of new knowledge; the necessary techniques for their production, analysis, and usage I have called scientific cinematography.

It offers much to the research worker which no other technique can supply; the permanent record of any movement, the change in time scale, the detailed analysis of the unique event, the use of invisible radiation, and, above all, its quantitative nature. These outstanding advantages have led to the use of cinematography in all the living and in all the inanimate sciences. The resulting benefits to research, as well as the limitations of cinematography, are fully set out in the introductory chapter and often considered in relation to the specific subjects of this book. A critical discussion of the appropriate techniques--cinemicrography, the making of human record films, medical and x-ray cinematography--precedes in each case the accounts of their usefulness in the biological, human, and medical sciences, the three main parts of this work (p. ix).

Contents Include: 1. Scientific Cinematography and the Research Film: Introduction. Part 1. The Biological Sciences. 2. Cinemicrography. 3. Biology. 4. Animal Behavior. Part 2. The Human Sciences. 5. Human Record Films. 6. Anthropology. 7. Psychology and Psychiatry. Part 3. The Medical Sciences. 8. Techniques in Medical Cinematography. 9. Techniques in X-Ray Cinematography. 10. Medicine. Epilogue, p. 371. Author and Reference Index, p. 375. Subject Index, p. 467 (Includes 1,490 references).

Ministerstvo vyisshego i srednego spetsial'nogo obrazovaniya sssr. ("Ministry of Higher and Secondary Specialized Education of the U.S.S.R."). Kino v nauchnom issledovanii. ("Cinema in Scientific Research"). Edited by B.V. Kubeyev. Moscow: Gos. Izd-vo, "Vyisshaya shkola, 1963. 107pp.

A collection of scientific research work conducted at Higher Educational Institutes during the years 1958-1962, with application to special forms of motion picture photography. A publication of the Educational-Methodological Administration for Higher Educational Institutes.

O'Brien, Richard S., ed. Color Television. [Selections from the Journal of the SMPTE]. New York: SMPTE, 1970. 223pp. illus.

Fundamental aspects of color television technology to include: Basic Color; Color Television Systems; Color Film; Color Television Cameras and Studio Practices; Color Television Broadcasting Facilities and Measurements. Includes Standards and Recommended Practices; Bibliography. Index.

Ott, John Nash. Health and Light: The Effects of Natural and Artificial Light in Man and Other Living Things. Introduction by James W. Benfield, D.D.S. Old Greenwich, Conn.: The Devin-Adair Company, 1973. 208pp. illus.

Studies and case histories showing subtle effects light technology is having on our physical and mental well-being and on the development of our children.

______. My Ivory Cellar: The Story of Time-Lapse Photography. Chicago, Ill.: Twentieth Century Press, Inc., 1958. 157pp.

Contents: L. Time-Lapse Photography; 2. Further Afield in Photography; 3. The Steady and Orderly Evolution of Plants; 4. Project Sixty One; 5. Growth Responses to Variations in Temperature; 6. Hindsight; 7. Pink or Blue? The Effect of Wave Length of Light Energy on Growth Responses in Plants; 8. Double Trouble; 9. Contemporsry Influences; 10. Interesting Similarities between Reactions of Plants and Animals; 11. Photocrinology--The Effect of Light on the Glandular System; 12. The Darkest Hour; 13. "Toot,Toot," Lectures Given by John Ott.

Photographic Techniques in Scientific Research. Vol. 2. Edited by A.A. Newman. New York: Academic Press, Inc., 1976. 447pp. [See Page 11 for information on Volume 1].

A collection of articles written by specialists reporting on applications of photographic techniques in various areas of science. Contents: Photography in Pharmacological Research. Some Aspects of the Reproduction of Diffraction Patterns. Infrared Photography, A Versatile Tool. Photography in Materials Science. Photographic Aspects of Archaeology. Author/Subject Index.

Powell, C. F., et al. The Study of Elementary particles by the Photographic Method. [An Account of the Principal Techniques and Discoveries Illustrated by an Atlas of Photomicrographs]. New York: Pergamon Press, Inc., 1959. 669pp. illus.

The methods employed in studying elementary particles and their properties by measurements on the tracks they produce in photographic emulsions and important discoveries thus made.

Quigley, Martin jr. Magic Shadows: The Story of the Origin of Motion Pictures. New York: Quigley Publishing Co., 1960. 191pp. illus.

Rieck, Joachim. Technik der wissenschaftlichen kinematographie. ("Techniques for Scientific Cinematography"). Munich: Johan Ambrosius Barth, 1968. 125pp. illus.

Contents: I. The Film Projector and Cinematographical Principles; II. The Normal Frequency Film Taking; III. Time-Lapse Equipment; IV. High-Speed Photographic Equipment; V. Evaluation of Scientific Films; Qualitative Evaluation, Quantitative Evaluation. Supplement: Symbols for Scientific Photography. Photometric Units. Sources for Illustrations. Bibliography. Index.

Rodionov, Boris N., et al., eds. Kosmicheskaya ikonika: Sbornik statei. ["'Cosmic Images' ('Space Photography'): Collection"]. Moscow: "Nauka," 1973. 239pp.

Addresses, Essays, Lectures and TV in Astronautics.

Rose, Albert. Vision: Human and Electronic. [A Volume in Optical Physics and Engineering]. Second Printing. New York: Plenum Press, Inc., 1974. 197pp.

Provides a unique approach to the study of the visual system: Examines the comparative sensitivities of the human eye, photographic film and imaging electronic systems. These disparate systems are assessed in terms of their fundamental quantum limitations and reports on research on the effectiveness of the electronic system in transmitting information with a minimum amount of light.

Sauveneir, H., ed. Scientific Photography. [Proceedings of the International Colloquium held at Liege, 1959. Sponsored by the Patrimoine de L'universite' de Liege]. A Pergamon Press Book, New York: The Macmillan Co., Inc., 1962. 617pp.

Contents: List of Participants. Section 1.1. Crystals; 3.1. Fundamental Processes; 1.2. Role of Gelatine; 1.3. Chemical Sensitization; 3.2. Errors of Reciprocity; 5. Optical Sensitization; 2a. Spectral Absorption and Sensitation of Dyes; 2b. The Mechanism of Optical Sensitization; 2c. Desensitization of Dyes. Index of Authors; Index--in English, French and German.

Schade, Otto H., sr. Image Quality. A Comparison of Photographic and Television Systems. Princeton, New Jersey: RCA Laboratories, 1975. 84pp. illus.

Describes three basic parameters that determine image quality. The intensity-Transfer Function (which is a measure of the gray scale), the Modulation-Transfer Function (which is a measure of sharpness and definition), and the particle or quantum density that can be stored in the sensor of the camera (which is a measure of granularity or noise).

Smirnov, Boris V. Osnovy elektroniki i tekhniki svyazi. ("Fundamentals of Electronics and Technology of Communications"). 2nd ed. Moscow: Kolos, 1974. 336pp.

Strasser, Alex. The Work of the Science Filmmaker. New York: Hastings House Publishers, Inc., 1972. 308pp. illus.

In the first section the works of art by da Vinci and Duchamp in their attempts to graphically portray motion are referenced. The film is discussed as a medium and as a language. The characteristics of silent and sound films are described and the author briefly treats visual perception illustrated with optical illusions and contemporary paintings that have been influenced by cinematic effects.

The next section is a general discussion of subject matter, the visible and invisible worlds, and the way of getting a desired message across to the audience. Section three is devoted to special techniques such as micro-and macro cinematography, masks and mattes, ultraviolet and infrared, schlieren, time-lapse, high-speed, optical printing, models, miniatures, animation and simulated animation.

The section "Films in the Making" deals with the making of scientific films, the problems encountered and their solutions. The concluding section "Film Making Procedures" describes the steps in a film production from the original proposal to the release print.

This volume contains an Appendix of Evaluation Forms used by the Canadian Film Institute for Science Films; A List of Science Film Libraries and related information. A bibliography and Glossary of film terms is also included.

Symposium on Photographic Sensitivity, Cambridge, 1972. Photographic Sensitivity. Proceedings of the Symposium on Photographic Sensitivity held at Gonville and Caius College and Little Hall, Cambridge, September, 1972. Edited by R.J. Cox. London and New York: Published for the Scientific and Technical Group of the Royal Photographic Society by Academic Press, Ltd., 1973. xv, + 409pp. [Includes Bibliographical References].

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CHAPTER VII

HIGH-VOLTAGE PHOTOGRAPHY

[KIRLIAN PHOTOGRAPHY]

AURAS, BIOENERGETICS, CORONA DISCHARGE PHOTOGRAPHY, RADIATION FIELD PHOTOGRAPHY, ELECTROPHOTOGRAPHY, KIRLIAN IMAGERY, THE BODY AS AN ENERGY FIELD

CHAPTER VII

HIGH-VOLTAGE PHOTOGRAPHY

[AURAS, BIOENERGETICS, CORONA DISCHARGE PHOTOGRAPHY, RADIATION FIELD PHOTOGRAPHY, ELECTROPHOTOGRAPHY, KIRLIAN IMAGERY, THE BODY AS AN ENERGY FIELD]

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METHODOLOGY. All data were secured from human volunteers. Hypotheses were as follows: Corona discharge will differ for different Ss; over-time; with emotional and physical changes. With increased alcohol intake, corona discharge will increase in size and redness. Subject groups were formed on the basis of sub-studies; Baseline, Alcohol, Individual Series.

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> A method of producing photographs from the action of high-frequency currents was developed. . . which consists in the conversion of the non-electrical ones through the action of a field with a directed transfer of charges from the object to a photographic plate or screen.

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CHAPTER VIII

ABSTRACTS, INDEXES, BIBLIOGRAPHICAL SOURCES

[SOURCES AVAILABLE FOR FURTHER RESEARCH AND STUDY]

CHAPTER VIII

ABSTRACTS, INDEXES, BIBLIOGRAPHICAL SOURCES

[SOURCES AVAILABLE FOR FURTHER RESEARCH AND STUDY]

A Bibliography of Metric Standards. New York: American National Standards Institute, Inc., 1974. 20pp.

A representative listing of metric standards adopted as American National Standards and by the International Organization for Standardization [ISO] and recommendations by the International Electrochemical Commission [IEC]. Designed to provide guidance on the availability of metric standards in addition to being useful as an introduction to material on metrication.

"Abstracts of Papers from other Journals," Journal of the SMPTE. Scarsdale, N.Y.: Society of Motion Picture and Television Engineers, Inc.

Abstracts are published from "time to time" and are chosen for their importance and research value as well as timely interest. Translations are made from abstracts of foreign journals and not of the papers themselves. Current issues of Tekhnika kino i televideniya ("Cinema and Television Techniques") [U.S.S.R.], can be borrowed from or consulted at the SMPTE Headquarters in Scarsdale, N.Y., and are readily available at the Doheny Library, Special Collections--Cinema, University of Southern California, Los Angeles, California.

Abstracts of Photographic Science and Engineering Literature [APSE]. Washington, D.C.: Society of Photographic Scientists and Engineers, 1300 Massachusetts Ave, N.W., 1962-1972. Monthly [Discontinued in 1972].

Prior to the publications discontinuance in 1972 it was published by the Graphic Arts Research Center, College of Graphic Arts and Photography, Rochester Institute of Technology, Rochester, N.Y., with the editorial cooperation of the SPSE. Subject areas included: Animation, Film and its Properties, General High-Speed Photography, Holography,

Lenses and Optics, Light Sources, Photographic Theory and Materials. This publication covered about 7,000 abstracts yearly from technical journals, photographic patents, technical meetings, proceedings, U.S. Government Research and Development Reports and other technical abstracting services. Translations from publications and patents from 36 countries were included. Publication was well organized, indexed and and cross referenced.

Ansco Abstracts. Binghamton, New York: Ansco, A Division of General Aniline and Film Corp. [now known as GAF]. 1941-1961. Monthly. [Discontinued in 1961].

Abstracts primarily prepared for Ansco personnel and based mainly on publications available at the Ansco Research Library. The literature and patent abstracts were separate and each group was further divided into three main sections: Chemistry and Physics; Photography and Miscellaneous. No numerical subject classification was used. An annual author index was also published.

Applied Science and Technology Index [Formerly Industrial Arts Index]. New York: H.W. Wilson Co., 1913--[Vol. 61 1973; Vol. 62-1974; Vol. 63-1975]. Published monthly except July.

A cumulative subject index to English language periodicals in the fields of aeronautics and space science, automation, chemistry, construction, earth sciences, electricity, electronics, engineering, industrial and mechanical arts, materials, mathematics, transportation and related subjects. Also includes a wide scope of subject matter on cameras, camera shutters, color photography, exposure meters, optical instruments, photography [aerial, high-speed, infrared, time-lapse], radiography, etc. No abstracts.

Barber, Edda. Astronautics Information. Literature Search No. 160. Photographic and Television Equipment and Techniques Adaptable to Space Flight. National Aeronautics and Space Administration Contract No. NASw-6. December 15, 1959. Pasadena, California: Jet Propulsion Laboratory, California Insitute of Technology, 1959. v + 83pp.

Foreword: In order to design an image-reproducing unit to be used in a space vehicle, information was requested on the following aspects of television and photography.

Airborne Photography. Many types of airborne cameras with various applications are reviewed. Material on the development of aerial photography and photogrammetry is included, with special emphasis on cameras and techniques; however, material

on mapping and terrain recognition have been omitted.

High-Speed Cameras. The development of high-speed cameras in the millisecond range is reviewed as well as accessories to these cameras, i.e., shutters and lenses. Ultra-high speed methods in the microsecond range such as image converters and rotating mirrors have not been included.

Astronomical Photography. Cameras and methods used for astronomical observations are included when applicable.

Television Development. Early writings on television and articles dealing with its history and development are included as possible sources of information on the older mechanical systems of television. There is additional material on modern television developments and applications of interest to spaceflight.

Television Scanning Systems. Emphasis is placed on mechanical scanning systems, and most of this section deals with the "flying-spot scanner."

Television Bandwidth Control. This material covers methods of reducing bandwidth while retaining maximum efficiency.

Television Cameras. In this search emphasis is given to the vidicon camera because of its compact size and greater sensitivity. Other types of cameras are included if pertinent application is mentioned.

Magazine articles are listed in chronological order by year within each subject category. These are followed by reports in alphabetical order by source, and books in alphabetical order by author.

The search is unclassified, and classified reports have been included only when the title and abstracts are unclassified, according to the ASTIA Technical Abstracts Bulletin.

The following sources have been consulted: JPL Book File; JPL Library Additions; JPL Source File; ASTIA files; Astronautics Information Abstracts, Volume 1, Parts A,B,and C; ASTIA TAB (to U59, #12); Publishers Guide to Books in Print; Physics Abstracts (PA), 1931-1949, 1953-1958; Electrical Engineering Abstracts (EEA), 1936-1952, 1954-1957; Engineering Index (EI), 1920-1957; Industrial Arts (IA), 1956-1957; Applied Science and Technology (AS&T), January 1958-October 1959.

Bibliography--Index to Current U.S. JPRS Translations; Soviet Union. [Volume 1--July, 1962--June, 1963]. Edited by Theodore E. Kyriak. New York: Research and Microfilm Publications, Inc., CCM Information Corp., Inc., A Subsidiary of Crowell Collier and Macmillan, Inc.

The title of this publication was changed to TRANSDEX beginning with VOL. IX, July 1970 - June 1971. A Bibliography and guide to contents of a collection of of U.S. JPRS Translations on the Social Sciences emanating from the U.S.S.R.

Bibliography of Bibliographies in the DDC Collection. Report Bibliography from January 1972 - February 1974. Report No. AD 780 700/GA; DDC-TAS-74-20. May, 1974. 448pp. [Updates AD 752 150 and AD 752 160].

A compilation of references which were processed into the DDC data bank. It contains 316 entries covering the period January 1972 through March 1974. Citations are arranged in 19 COSATE Subject Categories: Aeronautics, Agriculture, Astronomy and Astrophysics, Atmospheric Sciences, Chemistry, Earth Sciences and Oceanography, Electronics and Electrical Engineering, Energy Conversion (Non-Propulsive), Materials, Mathematical Sciences, Navigation, Communications, Detection and Countermeasures, Ordnance, Physics and Propulsion and Fuels. Corporate Author--Monitoring Agency, Subject, Title. Personal Author, Contract and Report Number, Indexes are included.

Bibliography of Infrared and Thermal Techniques for Non-Destructive Testing. Compiled and published by the Boeing Company--Vertol Division, Philadelphia, Penna., March, 1970. Distributed by the Infrared and Thermal Committee of the American Society for Non-Destructive Testing; [Available as NTIS Report No. AD 736 916] Springfield, Virginia: National Technical Information Service, 1970.

This bibliography contains the abstracts of 364 papers and reports which discuss the theory and applications of infrared and thermal methods as applied to NDT [Non-Destructive Testing]. The abstracts have been grouped into four basic categories: 1. Infrared Techniques for Electronic Circuits and Components (85); 2. Infrared Techniques for Materials and Structures (160); 3. Thermal (Non-Infrared Techniques (47); 4. Infrared Test Equipment.

Bibliography of N.S. Kapany. Revised October, 1965. 4pp. (53 Selections), No author or publisher listed.

Contains information on Fiber Optics, Lasers, and Optical Information Processing.

Bibliography of Selected Technical Publications Relevant to AVCO's Pulsed Laser Systems. Everett, Mass.: AVCO Research Laboratory Inc. [2385 Revere Beach Parkway].

Bibliography of Soviet Laser Developments. No. 5 July-September, 1971. Sponsored by Advanced Research Projects Agency. ARPA Order No. 1632. December 2, 1971. Principal Investigator Stuart G. Hibben. Prepared by Informatics Tisco, Inc. Riverdale, Maryland. 20840.

Introduction: This bibliography has been compiled by the staff of Informatics Tisco, Inc., in response to a continuing contractual assignment to monitor current Soviet-bloc developments in the quantum electronics field. Of all material reviewed, the major yield has been from the approximately 30 periodicals which are known to report the most advanced and interesting findings in Soviet laser technology.

The period covered is the third quarter 1971, and includes all significant laser related articles received by us during that interval. The structure and selection criteria are basically those used in the preceding reports.

For convenience we generally have abbreviated source names; a source abbreviation list and an author index are included. Unless indicated by a parenthesized reference Journal (Rzh) notation, all cited sources are available at Informatics Tisco, Inc.

Acknowledgement is due to the consultant effort of Mr. Yuri Ksander (Rand Corporation) for assistance in selection and structure of the material. (p. i.)

Table of Contents: Introduction, i; I. Basic Research. A. Solid State Lasers; B. Liquid Lasers; C. Gas Lasers; D. Chemical Lasers; E. UV Lasers; F. Components; G. Non-Linear Optics; H. Spectroscopy of Laser Materials; J. Ultra Short Pulse Generation; K. Crystal Growing; L. General Laser Theory. II. Laser Applications. Includes Biological Effects, Computer Technology, Holography, Instrumentation and Measurements, Materials Processing, Plasma Generation, Heating and Diagnostics, etc. III. Monographs. IV. Source Abbreviations. V. Author Index.

<ins>Bibliography on High-Speed Photography to 1960</ins>. Compiled by Elsie Garvin. Rochester, New York: Eastman Kodak Co., 1960. 48pp.

<ins>Bibliography on High-Speed PHotography: 1960-1964</ins>. Compiled by E.W. Tapia. Kodak Publication No. P-27. Rochester, New York: Eastman Kodak Co., 1965.

<ins>Bibliography on High-Speed Photography: 1964-1970</ins>. Compiled by Elizabeth W. Kraus., Edited by W.F. Walker. Rochester, New York: Eastman Kodak Co., 1970.

Reprinted in the <ins>Proceedings of the Ninth International Congress on High-Speed Photography</ins>, 1970, pp. 548-595.

<ins>Bibliography on Underwater Photography and Photogrammetry</ins>. Kodak Publication No. P-124. Rochester, New York: Eastman Kodak Co., 1972.

Boni, Albert., ed. Photographic Literature: An International Bibliographic Guide. In Two Volumes. Volume I. New York: Morgan and Morgan, Inc., 1962. 335pp.

______. Photographic Literature 1960-1970: An International Bibliographic Guide. In Two Volumes. Volume II [1st Supplemental Volume]. New York: Morgan and Morgan, Inc., 1972. xv+535pp.

An international bibliographic guide to general and specialized literature on photographic processes, techniques, theory, physics, apparatus, materials, applications, industry, history, biography, aesthetics, etc. Arrangement is alphabetical by subject with an author index. Briefly Annotated.

Chambers, R. P., and Courtney-Pratt, J. S. Bibliography on Holograms. Journal of the SMPTE. Vol. LXXV, No. 4 (April, 1966), pp. 373-435, and Vol. LXXV, No. 8 (August, 1966), pp. 759-809. [Reprinted as Bell Telephone System Monograph No. 5185].

Chemical Abstracts. Columbus, Ohio: American Chemical Society, 1907--Weekly.

Abstracts of journal articles, reports, books and patent literature. Section 74 includes radiation chemistry, photochemistry and photographic processes. Detailed Indexes.

Color Photography: A DDC Bibliography. April 1960-November 1969. In Three Volumes. Alexandria, Virginia: Defense Documentation Center, Cameron Station, April, 1970.

Volume I. AD 704 900. Unclassified-Unlimited. 117pp. 84 references. This bibliography contains references dealing with new achievements in the use of aerial photography for the geographic study of the terrain; study of additivie color photography for photographic interpretation; comparative photointerpretation from panchromatic color, and ektachrome infrared photography; and atmospheric effects on color aerial photography. Color by black-and-white film is also discussed.

Volume II. AD 865 550. Unclassified-Limited. 143pp. 106 references. This bibliography contains references ranging from techniques for production of color pictures from black-and white negatives to using aerial photography in different spectrum intervals to sutdy vegetation and soils. References include methods for compiling large scale soils maps using aerial photographs; pseudo color enhancement of biomedical images; and photoelectronic color separation by servomechanisms in cartography. Specialized photosensitive materials for laser research are also included.

Volume III. Classified.

Cosslett, V. E. Bibliography of Electron Microscopy. New York: Longmans, Green & Co.; London: Edward Arnold & Co., 1951. 350pp.

Courtney-Pratt, J.S., "Image Dissection in High-Speed Photography--A Bibliography," Journal of the SMPTE, Vol. LXXII, No. 11 (November, 1963), pp. 876-878.

"Current Bibliography on High-Speed Photography, 1964-1970," Compiled by Elizabeth W. Kraus and edited by William F. Walker, in Proceedings of the Ninth International Congress on High-Speed Photography, Edited by William G. Hyzer and William G. Chase. New York: SMPTE, 1970, pp. 548-595.

Defense Supply Agency. DDC Retrieval and Indexing Terminology; Preliminary Edition. Govt. Accession No. AD-773 300, January, 1974. Report No. DDLH 4185.7. Foreword by Ronald W. Mauer. Alexandria, Va.: Defense Documentation Center, Cameron Station, 1974. 717pp.

Natural language data base; vocabulary; index terms; retrieval terms; natural language; term dictionary.

Electrical and Electonics Abstracts: Science Abstracts Series B. Vol. 77, 1974; Vol. 78, 1975. INSPEC--The Institution of Electrical Engineers.

Sources include international journals, reports, books, dissertation, patents and conference papers.

Engineering Index, Inc. Engineering Index Monthly and Author Index. New York: Engineering Index, Inc., Since 1884. Monthly. [Volume 12, 1974; Vol. 13, 1975].

Transdisciplinary index to the world's engineering developments. Brief annotations. Entries are included for optics, photography and engineering applications of photography. [Also Engineering Index Annual Cumulation].

______. Author Affiliation Index to the Engineering Index Annual for 1973. New York: Engineering Index, Inc.

An author affiliation index which lists the names of organizations in alphabetical order and the material published by these organizations.

Engineers Joint Council. Thesaurus of Engineering and Scientific Terms. First edition. December, 1967. New York: Engineers Joint Council, 1967. 690pp.

This book is a major revision of an earlier title

Thesaurus of Engineering Terms (May, 1964). Foreword by Carl Frey. Terminology for this Thesaurus was gathered from approximately 350 subject indexing vocabularies, thesauri, glossaries and other specialized lists from scientific and technical disciplines.

ERTS [Earth Resources Technology Satellites]. "Bibliography," Part I. 1969-1971. International Aerospace Abstracts, Vol. XV, No. 7 (April 1, 1975), pp. 1-6.

_______. "Bibliography," Part II. 1972-1973. International Aerospace Abstracts, Vol. XV, No. 8 (April 15, 1975) pp. 1-8.

_______. "Bibliography," Part III. 1974, 1975. International Aerospace Abstracts, Vol. XV, No. 9 (May 1, 1975), pp. 1-10.

"ERTS" Program was redesignated as "Landsat Program" January, 1975. ERTS 1 & 2 are now noted as "Landsat" 1 & 2.

Feldman, Laurence M. "A Selected Bibliography on Optical Spatial Filtering," Optical Engineering: The Journal of the Society of Photo-Optical Instrumentation Engineers, Vol. II, No's 4 & 5 (July-October, 1972), pp. 102-112. [230 references].

Fielding, Raymond. "Special-Effects Cinematography: A Bibliography," Journal of the SMPTE, Vol. LXIV, No. 6 (June, 1960), pp. 421-424.

Available as a separate handout from the Society of Motion Picture and Television Engineers--Free of Charge.

Government Reports Announcements. [Since 1946--Semi-monthly; Format changed to three times a month in 1974; Combined with Government Reports Index in 1975]. Springfield Va.: NTIS.

Government Reports Index. [1965--Semi-monthly; Combined with Government Reports Announcements in 1975]. Springfield, Virginia: NTIS, (National Technical Information Service).

Contains subject, author, personal or corporate contract number and accession/report number for GRA listed above.

Guide to Instrumentation Literature. United States Department of Commerce, National Bureau of Standards. [Miscellaneous Publication No. 271--Supersedes Circular 567 (July 7, 1965), Julian F. Smith and W. G. Brombacher. Washington, D.C.: U.S. Government Printing Office, 1965.

Harris, Frankin S., jr. Laser Applications to Atmospheric Sciences: A Bibliography. NASA CR 2536. Springfield, Va.: NTIS, 1975. 134pp. [Contains 1460 references on the applications of lasers to atmospheric science].

Hibben, Stuart G. Bibliography of Soviet Laser Developments. [No. 16. April-June, 1974. Scientific Interim Report. 1 Nov. 1974]. Rockville, Md.: Informatics, Inc., 1974. 131pp. refs.

Coverage includes basic research on solid state, liquid, gas and chemical lasers; components; non-linear optics; spectroscopy of laser materials; ultra short pulse generation; crystal growing; theoretical aspects of advanced lasers and general laser theory. Laser applications are listed under biological effects; Communications; Computer Technology; Holography; Laser Induced Chemical Reactions; Instrumentation and Measurements; Beam Target Interaction, and Plasma Generation and Diagnostics.

________. Bibliography of Soviet Laser Developments. No. 17. [July-Sept, 1974. 29 January 1975]. Rockville, Md.: Informatics, Inc., 1975. 111pp. references.

Available as Accession No. A005 566 from NTIS, Springfield, Va. Same basic coverage as listed for No. 16 above.

________. Cumulative Author Index for Soviet Laser Bibliographies. No. 13-18. [July 1973 - December 1974. Interim Report. 30 May 1975]. Rockville, Md.: Informatics, Inc., 1975. 52pp.

A cumulative author index from Soviet Laser Developments--No's 13-18. July 1973-December 1974. Available as Accession No. AD A010035/4GA. Springfield, Virginia., NTIS.

________., and Winkus, Carl. Bibliography of Soviet Laser Developments. [No. 21, July - September 1975. Scientific Interim Report, 15 January 1975]. Rockville, Md.: Informatics Inc., 1976. 111pp. references.

Available as Accession No. AD A021 214/2GA from NTIS, Springfield, Virginia. Same coverage as listed for No. 16.

Holography: A DDC Bibliography. In three volumes. [October, 1964 to October, 1969]. Alexandria, Virginia: Defense Documentation Center, Cameron Station, (May), 1970.

Volume I. AD 704 950. 124pp. Contains 89 unclassified and unlimited references selected from documents entered in the DDC's Computer System between January 1960-December 1969.

Volume II. AD 868 800. Contains 100 unclassified and Limited distribution references selected from documents entered in the DDC Computer file between Jan. 1960 and Jan. 1970.

Volume III. AD 508 850. Classified.

Index 1976. Index to Kodak Information L-5. Rochester, N.Y.: Eastman Kodak Co., 1976. 46pp. [Major Revision].

International Aerospace Abstracts. New York: Technical Information Service--American Institute of Aeronautics and Astronautics. [Vol. 14, 1974; Vol. 15, 1975].

Lasers and Masers--Series I. [A Compilation of Abstracts]. Riverdale, Maryland: Cambridge Scientific Abstracts, Inc., 1974. pp. ii + 115 index + 492 + 8 Source Index.

A collection of 8,256 abstracts of articles that appeared in print from 1970-1973, covering areas of lasers, masers and quantum electronics.

Lemmon, Gene C., compiler. Bibliography of AFFTC Technical Publications and Presentations 1951-1964. Technical editor, Hugh Watt. [Technical Report No. 64-16, August, 1965]. Edwards Air Force Base, Calif.: Deputy for Systems Test (FTT), 1965. 141pp.

A compilation of Air Force Flight Test Center Technical Documentary Reports, Technical Notes, Technical Information, Memorandums and Technical Information Handbooks released prior to December 31, 1964.

Liquid Crystal Bibliography. Kodak Publication No. JJ-193. Rochester, New York: Eastman Kodak Co , 1973.

First Kodak publication to be made avaiable in microfiche consisting of 27 microfiche enclosed in individual vinyl jackets. It contains the equivalent of 2,700 pages of printed materials. An invaluable resoure for chemists, physicists and researchers working in the field of liquid crystal research. Contains 3,281 references to journal articles, theses, patents, government reports, conference abstracts, books and other sources from September 1888 to May, 1973. An author and sujbect index, a numerical-sequence file and a reference frequency file are also included. Each microfiche contains a microfiche index. (Price $25.00).

MacCann, Richard Dyer. "Good Reading about Motion Pictures; An Annotated Bibliography," Journal of the SMPTE, Vol. LXXII, No. 4 (April, 1963), pp. 322-324.

Available free of charge as a separate handout from the Society of Motion Picture and Television Engineers.

Malacara, Daniel; Corneju, Alejandro, and Murty, V.R.K. "Bibliography of Various Optical Testing Methods," Applied Optics, Vol. XIV, No. 5 (May, 1975), pp. 1065-1080.

A bibliography of various methods of optical testing with pages grouped by subject. A reasonably complete compendium; should be of value to workers in optical fabrication and testing.

Markhilevich, K., comp. Bibliograficheskiy obzor literatury po Kachastvo fotograficheskakh izobrazheniy opublikovannoi v 1964 g. ("Bibliographical Review of Literature for Quality Photographic Representation Published in 1964"). Moscow: Department of Scientific-Technical Information, State Committee Council of Ministers of the U.S.S.R., All Union Scientific Research Cinema-Photo Institute, 1965. 92pp.

Monthly Abstract Bulletin from the Kodak Research Laboratories. Rochester, N.Y.: Eastman Kodak Co. Monthly (1915-1961).

Annual volumes with annual authors' indexes intended to provide abstracts in English for members of Kodak research, manufacturing and technical depts. Also included abstracts of some articles in chemical, physical and technological literature deemed to be of special interest to the company's technical personnel. Abstracts of U.S. and foreign patents dealing with aspects of photography were also included.

Monthly Catalog of United States Government Pnblications. Washington, D.C.; U.S. Government Printing Office. 1976.

Beginning with Jnly 1976 (No. 928) new format utilizing AACR (Anglo-American Cataloging Rules) and Library of Congress Main Entries. Subjects are derived from Library of Congress subject headings 8th ed., and its supplements. The catalog consists of text and four indexes--author, title, subject and series/report no.

National Technical Information Service. U.S. Department of Commerce. Acoustic Holography. (A Bibliography with Abstracts). Report for 1964 - May, 1975. Accession No. NTIS/PS-75/432/5GA. Douglas M. Craig and Edward J. Lehmann. Springfield, Va.: NTIS, 1975. 97pp.

Aspects of acoustic holography: Theory, Equipment Design, Uses and Imaging Techniques. The applications include underwater and underground object locating, structural geology and tectonics, sonar imaging, nondestructive testing, antenna radiation patterns, nuclear reactor inspection, remote sensing and use in medical examinations. (92 Abstracts).

_____. Applications of Holography. (A Bibliography with Abstracts) Report for 1970-May, 1975. Accession No. NTIS/PS-75/431/7GA. Edward J. Lehmann. Springfield, Va.: NTIS, 1975. 235pp. (230 Abstracts).

Covers studies on the applications of holography in such areas as photographing high-speed particles, non-destructive testing of material defects, strain analysis, microscopy, interferometry, vibration measurement and medical diagnosis.

_____. Electroretinography. (A Bibliography with Abstracts). Report for 1964-July 1976. Pernell W. Crockett. August 1976. Accession No. NTIS/PS-76/0634/6GA. Springfield, Va.: NTIS. 1976. 94pp (89 Abstracts).

______. Fiber Optics.(A Bibliography with Abstracts). Search Period Covered--Oct 1969 - May, 1975. Acc. No. NTIS/PS-75/420. Springfield, Va.: NTIS, 1975. 147pp.

Topics include studies on fiber optical materials and their applications in such areas as display systems, communications equipment, television equipment, imaging devices, transmission lines, waveguides, integrated optical circuits, measuring instruments, detectors and recording systems (147 abstracts).

______. Holographic Flow Visualization. (A Bibliography with Abstracts). Citations from the NTIS Data Base. Report for 1964 - April, 1976. (May, 1976). Accession No. NTIS/PS-76/0338. Edited by Edward J. Lehmann. Springfield, Va.: NTIS, 1976. 68pp. (Unclassified). [Contains 63 Abstracts].

Aspects of flow visualization using holographic techniques. Studies cover flow in wind tunnels, gas lasers and shock waves. Most of the techniques involve interferometric holography.

______. Holographic Theory and Recording Techniques. (A Bibliography with Abstracts). Report for 1964-May, 1975. Accession No. NTIS PS-75/433/3GA. ed. by Douglas M. Craig, Edward J. Lehmann. Springfield, Va.: NTIS, 1975. 155p.

Topics include holographic recording techniques, theory, equipment and materials. Techniques discussed: Color holography, X-ray holography, High-speed holography, and Motion Picture holography. Photographic materials, films, emulsions, and equipment for recording and information storage are covered. Techniques for image motion compensation, image deblurring, wave front reconstructions and resolution are also presented.

______. Schlieren and Shadowgraph Photography. (A Bibliography with Abstracts). Report for 1964-October, 1974. Accession No. NTIS/PS-75/117/2GA. edited by Edward J. Lehmann. Springfield, Va.: NTIS, 1975. 154pp.

Applications and techniques of schlieren and shadowgraph photography are covered. Most reports are concerned with flow visualization althouth several studies on visualizing heat transfer and combustion processes are included.

New Technical Books. A Selective List with Descriptive Annotations. New York: The Research Libraries, The New York Public Library. [Printed and published monthly except during August and September (Vol. LX, 1975)].

A selective list of noteworthy English language imprints compiled from many new titles submitted for the monthly exhibits of new technical books in the Science and Technology Research Center, the Research Libraries, the New York Public Library. Noteworthy foreign works recently added to the center's collection may also be included from time to time.

Nuclear Science Abstracts. U.S. Atomic Energy Commission. A semi-monthly publication. [Vol. XXXI, 1975].

Comprehensive abstracting and indexing coverage of the international nuclear science literature. Covers scientific and technical reports of the U.S. Atomic Energy Commission, its contractors, other U.S. Government Agencies, other governments, universities and industrial and research organizations.

Photographic Abstracts. London: The Royal Photographic Society of Great Britain. 14 S. Audley St. London WiY 5DP, Great Britain. Vol. LV, 1975.

Abstracts from world literature of science, technology and applications of photography. Published monthly by the Scientific & Technical Group of the Royal Photographic Society.

Photomethods [Formerly PMI]; 1974 Reference Guide, Vol. XVII, No. 11 (November, 1974).

Contents: Books, magazines, catalogs and other sources of information and inspiration; Obtaining information in the Public Library; From the Visible Computer to the Invisible College; Photomethods Progress Report--Video Systems; Index to Imaging Information; The Necessity of Information--or the Cost of Ignorance; Index to Bibliography; Imaging Bibliography; Periodicals and Current Awareness Sources; Publishing--Essential to Health; Misc. Departments.

Photomethods; 1975 Reference Guide, Vol. XVIII, No. 11 (November, 1975).

Annual reference guide and progress report. Features include: Scientific Instrumentation by William G. Hyzer; Advances in Materials, Cameras, Electronic Imaging and Image Analysis are Reviewed. pp. 40-41, 8 references. "Imaging Book Shelves." Photographers in the Kodak Scientific Group, Faclutry Members at RIT, Photomethods Editorial Board Members and other friends give their personal recommendations of information sources. "Imaging Bibliography." Books are listed that have been published or brought to editors attention since the 1974 "Imaging Bibliography." Also includes the following column by William G. Hyzer, "Scientific Instrumentation: High-Speed Videography Update; Photogrammetry in a supersonic wind tunnel," pp. 8, 10, and 85-86.

Physics Abstracts: Science Abstracts Series A. INSPEC--The Institution of Electrical Engineers. Twice Monthly.

Includes several subject classification areas related to Photography, Cinematography, Optics, Lasers, Chemistry, etc.

Pittaro, Ernest M., ed. Photolab Index; Life-Time Edition. Thirty-Second edition, April 1974. Dobbs Ferry, N. Y.: Morgan and Morgan, Inc., 1974.

Recommended photographic procedures in a standarized form: Main Index. Section 0. Introduction and Main Index; 1. Agfa-Gevaert; 2. Dupont; 3. Eastman Kodak; 4. GAF; 5. Ilford; 6. 3M; 7. Polaroid; 8. Misc. Mfg; 9. Photographic Chemicals; 14. Cine Data; 15. Darkroom; 16. Color Data; 17. (Section held for further revisions); 18. Defects in Negatives and Prints; 19. Transparencies and Slides; 20 Copying; 21. Photo-Chemical Processes; 22. Special Processes; [23. Scientific and Industrial Materials; 24. Television].

Readers Guide to Periodical Literature (Unabridged). Bronx, N.Y.: The H.W. Wilson Co. Semi-monthly, Sept-June Inclusive, Monthly July-August, Vol. LXXV--1975.

Ringe, Jeanne Weber. Kirlian Photography; A Brief Bibliography. Report No. SR-74-02 for June 1964-March 1974. COM-74-10538. Springfield, Va.: NTIS, 1974. 11pp.

Schepler, Herman C. Bibliography of Photo-Optical Engineering. Redondo Beach, Calif.: SPIE, 1967. 11pp.

Lists over 300 books, texts and references on the engineering design, fabrication and application of photo-optical components and systems. Much of this material was compiled by William Price, many entries were taken from book lists published in Applied Optics 4 (1965) and other entries came from an optics bibliography previously published by Herman Schepler in 1964. Recent entries were taken from books lists of various publishers and from advertisements and book reviews in recent scientific and engineering journals.

Science et industries photographiques. Paris: Editions de la Revue d'Optique Theorique et Instrumentale. 1921 to March-April, 1968. Monthly.

Specialized in abstracts relating to principles, techniques and applications of world photographic literature. Abstracts ranged from brief summaries to abridged translations .

Science Research Abstracts. Part B. Laser and ElectroOptics Reviews; Quantum Electronics. Riverdale, Md.: Cambridge Scientific Abstracts, Ind.

International literature on masers and quantum electronics. Includes: Gas, Semi Conductor, Solid State, Liquid and Chemical Lasers and Masers; Electro-Optical Theory and Devices; Lasers and Electro-Optical Device Applications and Effects; Quantum Electronics.

Scientific and Technical Information Office, National Aeronautics and Space Administration. Remote Sensing of Earth Resources. A Literature Survey with Indexes. NASA SP-7036. September, 1970. Washington, D.C.: Scientific and Technical Information Division, Office of Technology Utilization. NASA, 1970. 1221pp.

Abstract: This literature survey lists 3,684 reports, articles and other documents introduced into the NASA scientific and technical information system between January 1962 and February 1970. Emphasis is placed on the use of remote sensing and geophysical instrumentation in spacecraft and aircraft to survey and inventory natural resources and urban areas. Subject matter is grouped according to agriculture and forestry, environmental changes and cultural resources, geodesy and cartography, geology and mineral resources, oceanography and marine resources, hydrology and water management, data processing and distribution systems, instrumentation and sensors, and economic analysis.

_______. Scientific and Technical Aerospace Reports--STAR. Washington, D.C.: National Aeronautics and Space Administration, Scientific and Technical Information Office, 1963----Semi-Monthly. Abstract Journal with Indexes.

Sheirs, George and Sheirs, May. Bibliography of the History of Electronics. Metuchen, New Jersey; The Scarecrow Press, Inc., 1972. 323pp. + xiii.

An annotated bibliography containing more than 1,800 listings of articles, books and other printed materials on the historical aspects of electronics and telecommunications from the 1860's to the present time.

Society of Photographic Scientists and Engineers. 11 Years of Photographic Science and Engineering. Washington, D.C.: SPSE, 1974. 135pp.

Includes an author index and a descriptor index of all articles published in Photographic Science and Engineering in the period 1957 through 1967. Includes 500 abstracts--grouped by subject matter.

Soviet Books on Photography, Cinematography and Related Fields of Knowledge in 1950. Zhurnal nauchnoy i prikladnoy fotografii i kinematografii ("Journal of Scientific and Applied Photography and Cinematography"), Vol. V, No. 3 (May-June, 1960), pp. 239-240.

Periodic bibliography.

Technical Translations. [Originally issued twice a month, Vol. I, No. 1 (January 2, 1959; Discontinued publication with Vol. XVII, No. 12 (December, 1967)].

Originally published by the U.S. Department of Commerce/ National Bureau of Standards/Institute for Applied Technology-- Clearing House for Federal Scientific and Technical Information. Materials have since been included in U.S. Government Research and Development Reports, beginning with Vol. LXVIII, No. 1 (January 10, 1968).

The Engineering Index, Inc. Engineering Index Thesaurus. New York: CCM Information Corporation, 1972. 402pp.

Primary focus of this thesaurus is plastics and electrical/ electronic engineering, though specialists in other fields of engineering sciences will find the thesaurus a valued reference work. More than 11,800 terms of descriptors are identified and cross-referenced.

Transdex: Bibliography and Index to the United States Joint Publications Research Service (JPRS) Translations. New York: Macmillan Information; A Division of Macmillan Publishing Co., Inc., 1971-1974. Discontinued in 1974.

Included complete bibliographic data on more than 30,000 newspaper and journal articles, books, reports, etc., that were originally published in the Soviet Union, China, Eastern Europe, Near and Middle East, Asia, Africa and Latin America. Contained Country; Title Index; Detailed Subject Index; Publications Index, and Author Index.

Transdex: Index--1975. Bell & Howell Co. An Index to Translations issued by the United States Joint Publications Service (JPRS). Wooster, Ohio: Compiled and published by Micro Photo Division, Bell & Howell Co., 1975. A Continuation of "Transdex" Listed Above.

Translations from the Scientific Literature, 1960-1973: Annotated Bibliography. June, 1974. Accession No. PB 236 385-T/GA; SFCSI-74-01. [Washington, D.C.: National Science Foundation, SFCSI--Special Foreign Currency Science Information Program] Available from Sprinfield, Va.: NTIS, 1974. 481pp.

Translations Register-Index. National Translations Center. Chicago, Illinois: John Crerar Library, 35 West 33rd Str., Vol. VIII, 1974; Vol. IX, 1975.

The center is a depository and information source for unpublished translations into English from world literature of natural, physical, medical and social sciences.

U.S. Department of Health, Education and Welfare. Public Health Service. National Institute of Health. Index Medicus Including Bibliography of Medical Reviews. National Library of Medicine. DHEW Publication No. NIH 75-252. Washington, D.C.: U.S. Government Printing Office. Volume 16--1975.

______.Soviet Medicine: A Bibliography of Bibliographies. Preface by Milo D. Leavitt, Jr., MD. DHEW Publication No. NIH 74-575. Washington, D.C.: U.S. Government Printing Office, 1973. 46pp.

A publication of the Geographic Health Studies Program of the John E. Fogarty International Center for Advanced Study in the Health Sciences. Prepared under an Inter-Agency Agreement with the Library of Congress.

Vsesoyuzniyi institut nauchnoy i tekhnicheskoy informatsii. ["All-Union Institute of Scientific and Technical Information" ("VINITI")]. Referativnyi zhurnal (Rzh) 46. Fotokinotekhnika. ("Abstract Journal 46. Photographic and Cinema Techniques"). Vol. 46. No. 1 (January, 1975), Moscow: VINITI, 44pp.

State Committee of the Council of Ministers, U.S.S.R., for Science and Technology and the Academy of Sciences of the Union of Soviet Socialist Republics. Editors, L.P. Semashko, and S.V. Kulagin. Vol. 46, 1975.

Contents: General Section 1.46.1. Contains books and transactions related to cinema technology, high-speed photography, photographic sensitivity, etc. 1.46.4. Photographic Processes (and Incorporating Apparatus for their Implementation; 1.46.56. Photographic and Cinematographic Materials; 1.46.71. Photographic Apparatus and Photographic Accessories; 1.46.150. Apparatus for Photoprinting and Photo Copying; 1.46.190. Optical Systems for Photography and Cinematography; 1.46.206. Motion Picture Filming Apparatus; 1.46.227. Processing, Editing and Motion Picture Printing Apparatus; 1.46.236. Projecting Apparatus; 1.46.271. Sound Recording and Reproduction of Sound in Cinematography; 1.46.273. Application of Photography and Cinematography in Science and Technology; Special Materials and Technology for Manufacturing a Photographic and Cinematographic Apparatus.

The All-Union Institute of Scientific and Technical Information "VINITI" has been publishing two periodicals for many years devoted to problems of photographic and cinematographic science and technology. The monthly Referativnyi zhurnal: 46. Fotokinotekhnika ("Abstract Journal: 46. Photographic and Cinema Techniques"), and the weekly Ekspress-Informatsiya fotokinoapparatura. Nauchnaya i prikladnaya fotografiya. ("Express-Information: Photography and Cinematography Apparatus. Scientific and Applied Photography").

Both publications are intended for a rather broad range of readers and specialists in cinematographic technology--scientific workers, engineers, and designers, at plants, design bureaus, scientific research institutes, motion picture studios, teachers and students of many higher educational institutions, inventors, workers of the motion picture network and television centers, and finally, for the numerous specialists in industry, agriculture, medicine, and popular education who make wide use of photography and cinematography for research and recording and documentation as well as one of the most important technical means for instruction. Both publications have gained great and deserved popularity among its readers and circulation of both journals has increased over the years.

World Index of Scientific Translations and List of Translations Notified to ETC. Monthly Publication of the European Translation Centre (ETC), 101 Doelenstraat, Delft, The Netherlands. Vol. VIII. 1974; Vol. IX, 1975; Vol. X, 1976.

The European Translation Centre (ETC) name changed in 1976 to International Translations Centre (ITC) ["Centre International De Traductions"]. Telephone 015-142242. Telex 31673.

This publication is comprised of two sections.

1. The World Index of Scientific Translations, lists available translations from East European and Asiatic languages into Western languages (both completed and in process) of serial articles, patents and standards relating to science and technology which have been notified to the "International Translations Centre." It also includes a number of social science translations and some other subjects. It is a general citation index, arranged according to the title of the original publication with a cross-reference to the List of Translations Notified to "ITC". Each third issue of this section is a quarterly cumulation. The last issue is a comprehensive cumulation for the whole year.

2. The List of Translations Notified to "ITC" announces the monthly acquisitions of translations by the Centre indicating complete bibliographical citations.

CHAPTER IX

BROCHURES, DISSERTATIONS, SPEECHES, MASTERS' THESES, REPORTS, TRANSLATIONS AND TECHNICAL NOTES

[DDC, NTIS, NASA, SANDIA LABS, ETC.]

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BROCHURES, DISSERTATIONS, SPEECHES, MASTERS' THESES, REPORTS, TRANSLATIONS AND TECHNICAL NOTES

[DDC, NTIS, NASA, SANDIA LABS, ETC.]

Brochures

Möllring, Friedrich K. Microscopy from the Very Beginning. Oberkochen, West Germany: Carl Zeiss, 1973. 66pp. illus.

This brochure is intended to furnish general information on microscopy which apply equally to all types and even makes of microscope.

Zeiss. Optical Systems for the Microscope. Oberkochen, West Germany: Carl Zeiss, 1971. 97pp. illus.

Dissertations

Henley, Donald Richard. Ultra High-Speed Photography Using a Pulsed Ruby Laser and an Acousto-Optic Beam Deflector. (Unpublished Ph. D. Dissertation, University of Illinois at Urbana-Champaign, 1973).

An ultra-high-speed framing camera has been designed primarily for use in the area of photomechanics. Photo-elastic fringes traveling at 78,000 inches per second have been filmed at framing rates of 100,000 frames per second. The field of view is 10 inches in diameter.

An acousto-optic deflector diffracts each successive burst of light from a Q-Switched Ruby Laser to a different lens in a large array. This array of lenses then acts as a light source for a camera of the familiar Cranz-Schardin Configuration.

All of the components of this system are capable of operating up to a million cycles per second. The electronics of the system have been designed so that the time of each exposure can be independently varied.

This camera has a great deal of potential in studying problems that are destructive in nature such as crack propagation problems. It has also been pointed out that with minor modifications the system can be used to obtain ultra high-speed holograms.

Pascu, Dan. The Motions of Satellites of Mars from Photographic Observations made in 1967, 1969, and 1971. (Unpublished Ph.D. Dissertation, University of Virginia, 1972).

Stevens, Alan Ray. Application of Color and Color Infrared Serial Photography to Dutch Elm Disease Detection. (Unpublished Ph.D. Dissertation, The University of Wisconsin, 1972).

Timm, Edward E. An Experimental Photographic Investigation of Vapor Bubble Collapse and Liquid Jet Impingement. (Unpublished Ph.D. Dissertation, The University of Michigan, 1974). 253pp.

High speed cinematography was used to experimentally investigate the collapse of spark generated vapor bubbles in water.

Yau-Chi Liu, Charles. Some Topics in Holographic Image Formation. (Unpublished Ph.D. Dissertation, California University, San Diego, 1974), 221pp.

The subject matter is divided into three major portions that can be called real-time holographic image formation, quasi-holographic image formation through the turbulent atmosphere, and holographic spatial filtering for differentiation. The aim of the first portion is to provide a method that allows formation of holographic images in real time, i.e., without any delay due to the hologram recording process. The aim of the second portion is to improve Labeyrie's method for astronomical observations through the turbulent atmosphere. The aim of the third portion is to produce in a very simple manner some spatial filters which can perform the mathematical operation of differentiation upon the object.

Speeches

Eisendrath, D.B. jr. "Some Notes on the History of High-Speed Photography," [Paper delivered at the M.I.T. Seminar on High-Speed Photography, August, 1960], Cambridge, Mass.: Massachusetts Institute of Technology, 1960.

Emens, Fred M. "High Speed Photography in Industry," [Paper No. 59-634. For Presentation at the 1959 Winter Meeting, American Society of Agriculture Engineers, Chicago, Illinois], (December 15-18, 1959), 9pp.

Masters' Theses

Coen, Karen S. "An Exploratory Study of High-Frequency Photography with a Modified Kirlian Apparatus," Unpublished Master's Thesis, United States International University, 1973. 88pp. illus.

Cohen, Louis Harris. "Photographic Instrumentation for Rocket Sled and Track Testing in Research and Development Projects," Master's Thesis, University of Southern California, 1968. xii + 332pp. [Published by Edwards AF Base, California: STINFO--Scientific and Technical Information Office, 1972. 348pp.].

Kaiser, Stanley Conrad. "Problems and Techniques in Obtaining Short Range Engineering Sequential Cine Photography During Missile and Space Launching Operations," Unpublished Master's Thesis, University of Southern California, 1963.

Myatt, Paul J. "A Survey of the Use of Motion Picture in Flight Training by the United States Navy," Unpublished Master's Thesis, University of Southern California, 1957.

Pellow, Charles David, "A Survey of Documentary and Technical Cine Photography at the Air Force Flight Test Center," Unpublished Master's Thesis, University of Southern California, 1965. 173pp.

Perrin, Donald George. "Film as an Instrument of Research," Unpublished Master's Thesis, University of Southern California, 1962.

Ryan, Roderick T. "The Application of a Quality Control Program to a Motion Picture Laboratory with Special Emphasis on the Processing of Color Films," Unpublished Master's Thesis, University of Southern California, 1956.

Sanders, A.A. "Modulation Transfer Function Measurements for Infrared Systems," Unpublished Master's Thesis, The George Washington University, Washington, D.C., 1970.

Stephens, William Emmett Jr. "A Survey of the Uses of Motion Pictures in Instrument Flight," Unpublished Master's Thesis, University of Southern California, 1951. 80pp.

Tudor, Ralph Neal. "An Investigation of the Technique and Application of High-Speed Photography," Unpublished Master's Thesis, University of Southern California, 1950. 97pp. illus.

Van Oss, Willis Burton. "High-Speed Photography: Its Problems and Limitations," Unpublished Master's Thesis, University of Southern California, 1951.

Welch, David L. "High-Speed Photography: Its Direct Application to General Secondary Education," Unpublished Master's Thesis, University of Southern California, 1960.

Reports, Translations and Technical Notes

Artyushin, L.F., and Ovechkin, N.S. "Theory of Photographic Color Representation," Uspekhi nauchnoy fotografii ("Progress in Scientific Photography"), No. 15 (1970), pp. 244-256. [Accession No. AD A008?64]. Springfield, Va., NTIS, 1974. 25pp.

Abstract: A review of the theory of color reproduction from its early beginnings in 1861. Deals with the research which has been carried out on color reproduction, graduation test methods, color correction and spectral and colormetric studies. Discusses the psychophysiological aspects of color reproduction and correction. (Includes extensive bibliography).

Basov, N., and Krokhin, O. "Laser--74," Izvestiya (February, 12, 1974), p. 3 (Accession No. JPRS 61768 (17 April 1974) Springfield, Va.: NTIS, 1974. [Contains 4 English Pages].

Examples of the intensive penetration during 1974 of quantum electronics in various fields of science and engineering.

Bates, O.H. Photo Instrumentation Technology. [A Two Year Program]. SLA-73-1052. Albuquerque, N.M.: Sandia Labs, 1974. 35pp.

Berger, Wallace, and Sanders, James H. Jr. Guidelines for the Use of Time-Lapse Photography in Transportation Research. Final Report, December 1975. Accession No. PB-254 676/OGA. Springfield, Virginia: NTIS, 1975. [BioTechnology, Inc., Falls Church, Va.].

The purpose of this report was to develop guidelines for the operational traffic engineer and the transportation researcher to determine when, where and how ot use time-lapse photography. This technique permits the large scale sampling of specific events where: the level of detail required, the cost involved, the elimination of field data bias due to the presence or interpretations of field data collectors, negates the use of observers or mechanical/electrical devices. Recommendations are made for data collection, data reduction and record keeping associated with both efforts.

Betensky, Ellis I. Improvements in Close Focusing with Lenses for 35-mm Cameras. Vivitar Report Series I. Stamford, Conn.: Opcon Associates, Inc. [Distributed by Ponder & Best Inc., 1630 Stewart Street, Santa Monica, California].

Bryant, L.E. Jr. Portable Flash X-Ray Systems: Techniques and Applications. [Accession No. LA-5756-MS. September, 1974. Los Alamos Scientific Lab., New Mexico. Springfield, Va.: NTIS, 1974. 16pp.

Advantages, limitations, applications, and techniques are given for 180-kV, 600kV, and 2.0-MeV portable Flash X-Ray systems. Suggestions are made for protection of equipment and film, for accurate pulse triggering, and for obtaining high quality images under constraints of blast and shrapnel from explosions. Flash radiographs--bullet and projectile trajectories.

Calella, Alexander J. Basic Theoretical Considerations of Light Amplification by Stimulated Emission of Radiation. [Accession No. AD 612 516]. Springfield, Va.: NTIS, 1964.

Derr, Albert J. Photography Equipment and Techniques: A Survey of NASA Developments. NASA SP-5099. Washington, D.C.: NASA, 1972. 182pp. illus.

The Apollo Program. . . . Photography has been used at each step of the way--to document the efforts. . . to record much that cannot be seen by the human eye. . . .
This document describes special uses of standard equipment modifications and new designs, as well as film combinations that indicate actual or potential ecological problems. . . .

Drobyshev, F.V., and Lobanov, A.N. "Development of Photogrammetry in the Soviet Union," Geodeziya i Kartografiya, No. 12 (1973). [Trans. by B. Kingsley and V. Vaguine. 16 May 1974. Charlottesville, Va.: Army Foreign Science and Technology Center, 1974. Available as Accession No. AD A002 761]. Springfield, Va.: National Technical Information Service, 1974. 26pp.

Significance of photogrammetry is discussed; Traces development from pre-revolutionary times in the USSR. Development after 1918 divided into three periods (1918-1929, 1930-1945, 1946 to present); each is discussed in terms of advances in technology and applications with special attention to those developed in the Soviet Union. Describes several devices.

Dugger, P.H., and Hill, J.W. Laser Photographic Techniques for Direct Photography in an Aeroballistic Range. (February, 1969); AEDC-TR-68-225. Accession No. AD 683 259. Springfield, Va.: NTIS, 1969.

Eastman Kodak Company. International Glossary of Photographic Terms. Rochester, N.Y.: Eastman Kodak Co., 1973. 95pp.

_______. Modulation Transfer Data for Kodak Films. 3rd ed. Rochester, N.Y.: Eastman Kodak Co., 1967. 15pp. Revised.

Fisher, U. "The Circulation under Exposure to Acceleration. X-ray Photography of Monkeys," Trans. of "Der Kreishauf unter beschleunigung. Röntgenaufnahem beim affen." Luftfahetmedizen, Vol. II (1938), pp. 1-13. Accession No. N67-31294. NASA TTF-11,061. Washington, D.C.: NASA, 1967.

Havener, George A., Capt. USAF. A Users Guide on Pulse Laser Holography for Wind Tunnel Testing. Wright-Patterson AFB, Ohio: Aerospace Research Laboratories/LH, 1975. vi+202pp.

High-Speed Photographic System for Moisture Flow Visualization in Steam Turbines. NASA TM-X2763. Springfield, Va.: National Technical Information Service, 1973. 12pp.

Hinman, R. J. Fundamentals of the Evaluation of the Qualities of the Photographic Image. New York: General Aniline and Film Corp., Photo & Repro Div., Government and Contract Sales, nd., 36pp. illus.

Holography and Optical Filtering. NASA SP-299 [A Conference Held at the Marshall Space Flight Center, Huntsville, Alabama, May, 1971]. Washington, D.C.: NASA, 1971.

Horner, J.L. Photographic Film Image Enhancement. Report No. DOT-TSC-NASA-75-1 [Final Report: Oct 1971-Feb 1975 (July 1975)]. Washington, D.C.: NASA, 1975. 56pp. illus.

A series of experiments were undertaken to assess the feasibility of defogging color film by the technique of optical spatial filtering.

Huck, Friedrich., et al. Prediction of Viking Lander Camera Image Quality. NASA TN-D-8148 (April, 1976). Washington, D.C.: NASA, 1976. 76pp.

Formulations are presented that permit predictions of image quality as a function of camera performance, surface radiance properties and lighting and viewing geometry.

Kuehnel, Helmut A. Apollo Experience Report--Photographic Equipment and Operations During Manned Space-Flight Progress. NASA TN-D6972. Report No. E-74-10509. Springfield, Va.: NTIS, 66pp. illus.

Kurtz, R. L. Real Time, Large Volume, Moving Scene Holographic Camera System. [Patent], 10 June 1975. Huntsville, Ala.: Nasa-Marshall Space Flight Center, 1975. 15pp.

A holographic motion picture camera system is described which produces resolution of front surface detail. The system utilizes a beam of coherent light and means for dividing the beam into a reference beam for direct transmission to a conventional film transport, and three reflection signal beams for transmission to the film transport by reflection from the three orthogonal sides of a moving scene.... The camera has the theoretical capability of producing motion picture holograms of an object moving at speeds as high as 900,000 cm/sec (about 21,450mph). The system has the capability of handling objects of relatively large volume moving in a random direction anywhere within a volume.

Lamar, J.V., et al. Pseudocolor Transformation of ERTS Imagery. Report No. P-5034. Santa Monica, Calif.: Rand Corporation, June, 1973. 14pp.

Llamas, J.S., and Thebert, J.B. High-Frame Rate Underwater Camera System. Report No. SLA-73-0399. July 1973. Albuquerque, New Mexico: Sandia Laboratories, 1973. 8pp. illus.

Nefedov, K.E., and Popova, T.A. Deshifrirovanie grontovykh vod po aerofotosnimkam. ("Deciphering of Ground Water from Aerial Photographs"). Trans. by V.S. Kothekar. NASA TTF-681. Published by NASA and the National Science Foundation by New Delhi: Amerind Publishing Co., Springfield, Va.: NTIS, xii+191pp.

1. Aerial Photography in Hydrology; 2. Photographic Interpretation.

Oganesyan, R.O. Electron Microscope Data on the Development and Structure of the Retina. Report No. AD 770 725/OGA; FSTC-HT-23-2127-72. Translation of Nauchnye Doklady Vysshei Shkoly Biologicheskie Nauki (U.S.S.R.), No. 8 (80), pp. 5-15, 1970. Charlottesville, Va.: U.S. Army Foreign Science and Technology Center, November, 1973. Springfield, Va.: NTIS, 1973.

Parthasarathy, R. Photography at Radiowavelengths. Final Report June 71-Sept 74. Accession No. AD-A012 858/7GA, March, 1975. Springfield, Va.: NTIS, 1975. 62pp.

Description of the concept and instrumentation developed for imaging radiowave object fields. The electromagnetic field in the plane of an antenna array is specified by the waves arriving from different directions. The complex electromagnetic field may be sampled by the antennas in the array, faithfully amplified through those many identical receivers, to energize an equivalent array of ultrasonic emitters. The Fraunhofer image formed by the ultrasonic array may then be converted to yield a visible image. The imaging system developed is a one-dimensional version. It consists of a row of 20 antennas (equiangular spirals), 20 identical, high gain receivers and a linear array of ultrasonic emitters. The one-dimensional ultrsonic image is then detected by an array of 'pinducers', amplified and made to proportionately illuminate a row of L.E.D. light bulbs. The L.E.D. row is then photographed by means of a continuous run, 16-mm camera.

Phipps, G.S. Large Aperture Electrooptic Photographic Shutter. [Report No. SLA-74-0101. April, 1974. Albuquerque, N.M.: Sandia Laboratories [Photometrics Division], 1974. 19pp.

Abstract: Electrooptic shutters have been fabricated for experimental and special purpose applications....This report describes the theory, construction and problems associated with the use of a PLZT shutter in an imaging system[Lanthanum-Modified Lead Zirconate Titanate (Ferro-electric Ceramic)].

Pinkney, H.F.L., et al. Application of a Photographic Method to Study the Luminance Distribution Governing Visibility in Night Driving. April, 1976. Ottawa: National Research Council of Canada, 1976. 33pp. [NRC Report No. 15350].

Range Commanders Council. A Glossary of Range Terminology. Document No. 104-64, Revised. White Sands Missile Range, New Mexico: Secretariat Range Commanders Council, 1968.

______. Optical Instrumentation. Final Report, December, 1969. White Sands Missile Range, New Mexico: Optical Systems Working Group, 1969. 27pp. [Available as Accession No. A010 317/6GA, Springfield, Va.: NTIS].

Ritchie, E. E., and Lampson, F. K. "A Photographic Technique for Measuring High Temperatures," Advances in Instrumentation. [Proceedings of the 25th Annual ISA Conference, Philadelphia, Pa., USA, 26-29 Oct 1970] Pittsburg, Pa.: Instrument Society of America, 1970. pp. 617/1-4.

Marquardt has developed a unique method for measuring temperatures from about 1600°F to well over 4000°F. The method incorporates a radiation sensitive color film developed for use over an extreme range of light conditions, where exposures are unpredictable or where the subject brightness varies over enormous limits. This multilayer film is virtually impossible to overexpose. Samples of materials to be evaluated in service are incremently heated to known temperatures in the laboratory and photographed after each test run. These photographs are used to generate a color density vs temperature curve for each material. Comparison of relative color density of the test components provides a complete temperature profile with an accuracy of ±1%.

Rusinov, M.M. "Problems of Stereopanoramic Photography," U.S.S.R. Izvestiya vysshikh uchebnykh zavedeniy, geodeziya i aerofotos"yemka, No. 2 (March-April, 1965). [Available as TT 66-32627, JPRS 36194 (June 27, 1966)], Springfield, Va.: NTIS. 1966, 7pp.

Sharpsteen, James T., et al. Development of A Drive System for a Sequential Space Camera. Final Report March, 1976 (Perkin-Elmer Corp). Prepared for NASA. Houston, Texas: Johnson Space Center, 1976. 8?pp. [NASA-CR-147535].

Shatsky, J. A., and Jacobson, S. H. Design Considerations for Stop-Motion Cinefluorography at 500 Frames per Second. Report AFRRITN 73-1. Bethesda, Maryland: Armed Forces Radiobology Research Institute Defense Nuclear Agency, January, 1973. 14pp. illus.

Abstract: A prototype cinefluorographic system operable to 500 frames per second was assembled to test the feasibility of high-speed x-ray cinematography. The stop-motion capability of the device is absolute for biomedical research and is based upon a repetitively pulsing flash x-ray source with a 30-nsec exposure time. A discussion of repetition rate and resolution-limiting factors is presented in depth.

Siegmund, Walter P. Fiber Optics: Principles, Properties and Design Considerations. [Presented at the 6th Annual Meeting of Avionics Panel AGARD (NATO), Paris, France, July, 1962]. Southbridge, Mass.: American Optical Corp., 1962. 26pp.

Describes basic principles and properties of fiber optics materials as well as important design considerations with respect to application of these materials to various optical problems. A number of specific optical problems and possible solutions by means of fiber optics are described.

______. Ultrahigh-Speed Photographic Objective. [Report No. ALTDR-64-259. Accession No. AD 454 564 December, 1964]. Springfield, Virgina: National Technical Information Service, 1964.

Smith, Paul. [RADC/IRRS Griffiss AFB, N.Y.]; Peich, Kenneth R., and Walker, J. E. [Calispan Corp., Buffalo, N.Y.]. Special Color Analysis Technique. 18pp. illus.

Abstract: A new interpretation technique and the associated equipment for extracting additional intelligence from reconnaissance sensor records is described. Reconnaissance sensor imagery is a film record of images having spatial and photometric properties. Image spatial properties such as size, shape and pattern can be enhanced through the use of aids such as magnification, mensuration and stereo equipment. On the other hand, no operational equipment exists to enhance image photometric properties such as tone, color, contrast and density, which are a function of ground object reflectance and contain valuable intelligence information. The new technique enhances photometric properties by generating and displaying ratios of target reflectance using the spectral layers present on color and color infrared film. The photometric properties are presented in new spatial patterns for interpretation by the interpreter. An example using the ratio technique to evaluate surface texture is given. . . .

Summers, Roger B. Analysis of the Resolution Capabilities of Photosensitive Material. [Accession No. AD 454 568-- November, 1964]. Springfield, Va.: NTIS, 1964.

Thompson, B. J., and Shannon, R. R. Space Optics, Proceedings. [The International Congress of the International Commission for Optics--9th--Held at Santa Monica, California on October 9 - 13, 1972]. Washington, D.C.: National Committee for the International Commission for Optics (April), 1974. 833pp.

Presents 47 of the technical papers in the field of Space Optics. Categories include: Space Systems; Ultra-Violet Instruments; Infrared Methods; Communications and Radiometry; Thin Films; Image Processing and Holography; Optical Technology; Optical Methods; Instrumentation.

Tolchin, V. G., and Turukhand, B. C. "Color Holography," Materialy 5-y vses shkoly po golografii, 1973. pp. 345-356. [Available in English Translation as Accession No. JPRS 64174 (Joint Publications Research Service)].

Abstract: The idea of color and its application to color holography are examined. Primary attention is given to experimental methods of recording multicolored, thin film types of holograms, which reproduce the natural colors of the object when restored in white light. A color regeneration of a thin film hologram recorded in the light of a half wave impulse laser is provided.

Touffait, A. M. Applications of Acoustical Holography. CONF-740982-1 May 1974 [In French. CEA-CONF-2635/CEA--Centre d"Etudes Nucleaires de Saclay, 91 Gif-Sur Yvette (France), Div-de Metallurgie et d'Etude des Combustibles Nucleaires]. 1974. 17pp. [Available from Springfield Va.: NTIS. U.S. Sales Only. ($4.00)].

From the course on nondestructive control by special techniques, Lyon, France (24 Sept. 74). Two types of holographs--used for holography in real time and the other for scanning holography are briefly described.

Vinogradov, B. V. "The Effect of Clouds on the Identification of the Earth's Surface in Visual Observations and Photography from Space," Meteorologiya i gidrologiya. ("Meteorology and Hydrology"), No. 4 (1974), pp. 43-50. Available as Accession No. N74-25953, Springfield, Va.: NTIS, 1970.

Willingham, Charles B. Advanced Techniques for Improving Laser Optical Surfaces. [1 Sept. 1974. Semi-Annual Report No. 2 for period 1 January 1974 to 30 June 1974. Report No. AFCRL-TR-74-0384. Unclassified. Sponsored by Defense Advanced Research Projects Agency ARPA Order No. 2415. Monitored by Air Force Cambridge Research Laboratories, AFSC USAF, Hanscom AFB, Mass.]. Waltham, Mass.: Raytheon Research Division, 1974. 72pp.

This program is a study of surface-finishing techniques considered to be capable of improving the surface quality of laser optical materials. A variety of conventional and "super polishing" techniques were developed for single crystal and polycrystalline potassium chloride and calcium fluoride, and polycrystalline zine selenide.

Yutsevich, Yu. K. [Deceased], and Yunutsh, D. A., eds. Issledovaniye opticheskikh svoystv prirodnykh ob'yektov i ikh aerofotograficheskogo izobrazheniya. ("Investigation of Optical Properties on Natural Objects and their Aerial Photographic Image Formation"). Leningrad: Izd-vo, "Nauka," ("Science Press"), Leningrad Branch, 1970. 168pp.

English language translation by the Army Foreign Science and Technology Center, Charlottesville, Virginia. Available as Report No. AD 756 604 (December 8, 1972). Distributed by Springfield, Virginia: U.S. Department of Commerce, National Technical Information Service, 5285 Port Royal Rd., 1972.

Technical Bulletins

Nikon Instrument Group. "Microscopes: Microscope Objectives," Nikon Technical Bulletin. San Francisco, Calif.: Nikon Instrument Group, 501 Folsom St., nd. 19pp. illus.

Contents: Introduction; Basic Optical Configuration; Lens Aberrations and Their Compensation; Classification of Objectives; Conclusion. [Tables of Nikon Microscope Objectives].

______. "Microscopes: Some Basic Facts About Microscopes," Nikon Technical Bulletin. San Francisco, Calif.: Nikon Instrument Group, 501 Folsom St., nd. 27pp. illus.

______. "Theory and Practice of Photomacrography by Multiphot," Nikon Technical Bulletin, San Francisco, Calif.: Nikon Instrument Group, 501 Folsom St., nd. 18pp. illus.

Contents: Introduction; Basic Photomacrography; Theory of Photomacrography; Nikon's Multiphot; Practice of Photomacrography; Samples of Nikon Multiphot Photomacrographs; Specifications of Nikon Multiphot. Conclusion.

CHAPTER X

KINESIOLOGY: SELECTED MATERIALS

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Anderson, C. C. A Method of Data Collection and Processing for Cinematographic Analysis of Human Movement in Three Dimensions (Unpublished Master's Thesis, University of Wisconsin, 1970).

Brunnstrom, Signe. Clinical Kinesiology. 3rd ed. Revised by Ruth Dickinson. Philadelphia, Pa.: F.A. Davis, Co., 1972. xi, + 349pp. illus.

Cooper, John M., and Glassow, Ruth B. Kinesiology. 3rd ed. St. Louis: C.V. Mosby Co., 1972. x + 332pp. illus.

______., and Sorani, R. P. "Use of the Dichroic Mirror as a Cinematographic Aid in the Study of Human Performance," Research Quarterly [AAHPER--American Association for Health, Physical Education and Recreation], Vol. XXXVI, No. 2 (May, 1965), pp. 210-212.

Cureton, Thomas K. "Elementary Principles and Techniques of Cinematographic Analysis as Aids in Athletic Research," Research Quarterly [AAHPER], Vol. X, No. 2 (May, 1939), pp. 3-24.

DeVries, Herbert A. "A Cinematographical Analysis of the Dolphin Swimming Stroke," Research Quarterly [AAHPER], Vol. XXX, No. 4 (December, 1959), pp. 413-422.

Doolittle, T. L. "Errors in Linear Measurement with Cinematographical Analysis," Kinesiology Review, Vol. LXXVII, (1971), pp. 32-38.

Hockman, Ned. How to Make Good Coaching Movies. Kodak Data Book No. S-19. Rochester, N.Y.: Eastman Kodak Co., 1965. 40pp. illus.

Hopper, Bernard J. The Mechanics of Human Movement. London: Crosby Lockwood Staples, 1973. viii + 175pp. illus.

International Seminar on Biomechanics, 2nd. Eindhoven, Netherlands. 1969. Biomechanics II, Proceedings. Edited by J. Vredenbregt and J. Wartenweiler. Baltimore, Md.: University Park Press, 1971. xi, + 336pp. illus. [Medicine and Sport, Vol. 6].

International Seminar on Biomechanics, 3rd. Rome, Italy. 1971. Biomechanics III. Proceedings. Edited by S. Cerquigline, A. Venarando and J. Wartenweiler. Baltimore, Md.: University Park Press, 1973. xi + 511pp. illus. [Medicine and Sport, Vol. 8].

International Seminar on Biomechanics, 4th. University Park Pa., 1973. Biomechanics IV. Proceedings. Edited by Richard C. Nelson and Chauncey A. Morehouse. Baltimore, Md.: University Park Press, 1974. x + 607pp. illus.

Kelly, David L. Kinesiology: Fundamentals of Motion Description. Englewood Cliffs, N.J.: Prentice Hall, 1971. xi + 337pp. illus.

Kinesiology Review. Washington, D. C.: Council on Kinesiology, American Association for Health, Physical Education and Recreation.

Kinesiology. 1973. Washington, D. C.: Committee on Kinesiology, American Association for Health, Physical Education and Review. Annual. Continues Kinesiology Review.

Lekhtman, Yakov Borisovich. Vegatativnaya nervnaya sistema i ee rol' v dvigatel'noy deyatel'nosti cheloveka. ("Vegitative Nervous System and Its Role in Motive Activity of Man"). Leningrad: "Meditsina," Leningrad Section. 1969. 182pp. illus. [Bibliography pp. 173-180].

Logan, Gene A., and McKinney, Wayne C. Kinesiology. Dubuque, Iowa: William C. Brown Co., 1970. 328pp.

Miller, Doris I., and Petak, Kenneth L. "Three Dimensional Cinematography," Kinesiology Review, Vol. LXXIX (1973).

Nelson, Richard C., Petak, Kenneth L., and Pechar, Gary S. "Use of Stroboscopic Photographic Techniques in Biomechanics Research," Research Quarterly, Vol. XV, No. 2 (May, 1969), pp. 424-426.

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Plagenhoef, Stanley. Patterns of Human Motion--A Cinematographic Analysis. Englewood Cliffs, New Jersey: Prentice-Hall, 1971. ix + 224pp. illus.

Roche, D. P. "Photographic Analysis of Foot Placement in Skilled Runners," Journal of the SMPTE, Vol. LXXXI, No. 2 (February, 1972), pp. 114-116.

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Sharkey, Brian J. Physiology and Physical Activity. [Harper Series on Scientific Perspectives of Physical Education], New York: Harper & Row, 1975. xi + 220pp.

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Walton, J.S. Photographic and Computational Techniques for Three Dimensional Location of Trampolinists.(Unpublished Master's Thesis, Michigan State University, 1970).

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Boelter, John Gordon. A Biplanar Cinematographic Biomechanic Analysis of a Movement Pattern Demonstrated by Trainable Mentally Retarded Children and their Peer-Comparison Groups. (Unpublished Ph.D. Dissertation, University of Southern California, LA, Calif., 1975), 123pp.

_______. "Tri-Dimensional Cinematographic Data Recording: A Flexible Approach," (Unpublished Paper, Photography in Scientific Research--Cinema 428, University of Southern California, LA, Calif., 1974), 6pp. Diagrams.

Sloan, John H. "Discussion of Analysis in Biomechanics and the Application of Cinematography as a Tool for the Investigstion of Human Performance," (Unpublished Paper, Photography in Scientific Research--Cinema 428, University of Southern California, LA, Calif., 1974), 18pp.

CHAPTER XI

JOURNALS AND PERIODICALS

SECTION 1: SELECTED ARTICLES

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"A Camera Trick to see in the Dark," New Scientist, Vol. LXV, No. 933 (January 23, 1975), p. 205.

Aloway, J.; Moore, C. B., and Vonnegut, B. "Cameras for Time-Lapse Photography," Applied Optics, Vol. IX, No. 8 (August, 1970), pp. 1811-1813.

Anderson, Robert J., and Grimshaw, William F. "Evidence Photography in an Underwater Tunnel," The Professional Photographer, Vol. CI, No. 1951 (December, 1974), pp. 52-54.

"A New Concept in Light Microscopy," Photographic Applications in Science, Technology and Medicine, Vol. VIII, No. 4 (July, 1973), pp. 22, and 32.

Aspden, F. L. "Electronic Flash Photography," Aircraft Engineering, Vol. XXIII (December, 1951), pp. 354-360.

A review of the applications of electronic flash photography in the development, instrumentation and operation of aircraft. illustrated.

Babits, Victor A. "What is Color?" Technical Photography, Vol. III, No. 6 (June, 1971), pp. 12-14.

Discusses the early history of color, the physics of color, color perception, color concepts, color standards, the psycho-physical aspects of color. Includes 15 references.

________. "Ultrahigh-Speed Photography," Technical Photography, Vol. III, No. 7 (July, 1971), pp. 1, 14-15, and 25. Includes 6 references.

Bacchi, H., and Eschard, G. "Ultrahigh-Speed Photography," Philips Technical Review, Vol. XXX, No. 8/9/10 (August/September/October, 1969), pp. 241-251. [Published on the 19th December 1969].

Briefly reviews research and various types of cameras used for ultrahigh-speed photography; Describes several image-converter shutter tubes and various cameras developed and produced at LEP [Laboratoires d'Electonique et de Physique Appliques, Limeil-Brevannes (Val-de-Marne), France.

Bagley, Charles H. "Trapping Time with Photography," Industrial Research, Vol. XLVII, No. 4 (July-August, 1962), pp. 15-23.

Baluteau, J. M. "New Ultra High-Speed Camera," Nouvelle Revue d'Optique Appliquee, Vol. III, No. 1 (Jan-Feb, 1972), pp. 11-16. (In French).

Principles of ultra-high-speed cameras are shown; a framing and "total activity" [picture sequence can be started an any mirror position] camera is described. Emphasizes "Multiplier" divice which enables one to double the scanning speed of the beam. Specification of the rotating mirror determining the total activity is also emphasized.

Baranov, V. Yu. et al. "Lasers and Their Applications," Pribory i tekhnika eksperimenta. ("Instruments and Technical Experiments"), No. 5 (1973), pp. 189-199. Accession No. JPRS-62679, August 8, 1974, 21pp in English Springfield, Va.: NTIS.

Contents: High-Pressure Cathode Preionization Pulse CO-2 Laser; Organic Dya Accessory for LGI-21 Serial Nitrogen Laser; Application of Lasers for High-Speed Photography of Fast Processes; Fabry-Perot Laser Interferometer for Measuring Plasma Density in Unsteady Flow.

Barclay, A. "Early High-Speed Photography," British Journal of Photography, Vol. CIII (November 16, 1956), pp. 588-593.

Belozerov, A. F., and Spornik, N. M. "Poluchenie tsvetnykh tenevykh kartin pri issledovanii volnovogo fronta vosstanovlennogo s gologrammy" ("Attainment of Color Shadowgraphs in the Study of a Wave Front Reconstructed from a Hologram"), Geodeziia i aerofotos"yemka ("Geodesy and Aerial Photography"), No. 1 (1974), pp. 131-141.

Berg, W. F. "Photography in Scientific Research," Nature [London], Vol. CXLIV (August 26, 1939), pp. 356-358.

Block, O. "Applications of Photography to Scientific and Technical Problems," Journal of the Royal Society of Arts [London], (1937), p. 651 (A General Review).

Bova, Ben. "Lasers," R/D Research/Development, Vol. XVIII, No. 12 (December, 1967), pp. 30-34.

Brandberger, Arthur J. "What Can Photos Tell Us?" International Science and Technology, No. 67 (September, 1967), pp. 56-62, and 65-66. [Also see "To Dig Deeper," pp. 100, 102].

Photogrammetry is a way to determine the size and shape of an object. While a photograph gives an illusion of depth, it is only a two-dimensional reproduction. If the camera has a constant geometrical relation between the image plane and the lens it can serve as a kind of theodolite. The article relates how a subject can be reconstituted three-dimensionally by establishing a series of points using the cameras geometry.

Breido, I. I., and Mikhailova, O. M. "Fotografirovaniye predel'no slabykh iskusstvennykh svezd na razlichnykh fotograficheskikh materialakh," ("Photographing Extremely Weak Artificial Stars with Various Photographic Materials") Zhurnal nauchnoy i prikladnoy fotografii i kinematografii ("Journal of Scientific and Applied Photography and Cinematography"), Vol. XX, No. 2 (March-April, 1975), pp. 113-121. 11 references, 2 tables, 7 diagrams. Article in Russian; References in English and Russian. Abstract included page 160.

An astrosensitometer, which models stars against the sky background was used to study the ability of photographic materials to record extremely weak stars. It was shown that increasing the exposure time when photographing stars is effective only until the optical density of the background reaches 0.7-1.0. Increasing the exposure time further, thereby further increasing the background optical density, does not make it possible to record weaker stars. It was found that with a given background brightness, some fine-grained, low-sensitivity photographic plates can record stars which are ten times fainter than coarse-grained, high-sensitivity plates can. The study showed that when the image diameters is decreased, the maximum sensitivity of the photographic material to stars also decreases.

Brown, David A. "Data Show Venus Young, Evolving Planet," Aviation Week & Space Technology, Vol. CIII, No. 18 (November 3, 1975), pp. 19-20.

Data and photographs returned from Venera-9 and-10 Soviet Venus Lander Spacecraft portray a well-lighted, rocky surface belonging to a young, evolving planet (p. 19).

Cade, C. M. "Seeing by Heat Waves," Discovery: The Magazine of Scientific Progress, Vol. XXII, No. 10 (October, 1961), pp. 432-437.

Cannon, Theodore W. "A Camera for Photography of Atmo-spheric [sic] [Atmospheric] Particles from Aircraft," Review of Scientific Instruments, Vol. XLV, No. 11 (November, 1974), pp. 1448-1455.

A special camera has been installed on a research sail-plane to take in situ photographs of atmospheric particles. Ice particle shapes, sizes, and concentrations; raindrop sizes and concentrations; and estimates of cloud droplet concentrations and maximum sizes are obtained from the photographs. The camera is capable of photographing particles as small as 4u radius; the size of the largest particle completely images is limited by the 24x36 mm projected area photographed. Liquid particles can be distinguished from ice particles for radii greater than 50 u. Techniques are described for calibrating the camera so that both in-focus and out-of-focus images are used for obtaining concentration and size data. Examples of photographs of ice particles, raindrops, and cloud droplets are shown. Camera improvements for getting more data for a given length of flight are suggested. (p. 1448).

Chapline, George, and Wood, Lowell. "X-Ray Lasers," Physics Today, Vol. XXVIII, No. 6 (June, 1975), pp. 40-45, and 48.

Experiments with high-power lasers may soon demonstrate stimulated emission of x-rays; future devices could have far-reaching impacts on chemistry, biology and crystallography.

Chesterman, W. Deryck. [H.M. Underwater Detection Establishment Royal Naval Scientific Service). "High-Speed Photography in Naval Research," Research Applied in Industry, Vol. XI, No. 8 (August, 1958), pp. 301-309. [London: Butterworths Scientific Publications].

For much research on naval problems, high-speed photography is a valuable observational tool. Examples are given in the fields of hydroballistics, explosion research, cavitation and flow problems, and chemical studies. Recent developments in rocket research and the earth satellite programmes have provided striking advances but much fundamental work on techniques and materials remains to be done (p. 301).

_______. "The Scope of High-Speed Photography," Journal of Photographic Science, Vol. V (1957), pp. 102-105. Includes 9 references.

The two fundamental parameters which define most high-speed systems are picture exposure time and frame repetition rate. The author reviews various light sources, continuous and short duration. Air sparks and xenon-filled gas tubes according to the author have the advantage of short duration of a few micro-seconds and can be used either as single or multiple flash.

Chibisov, K. V. "The Development of Scientific Photography in Pre-Revolutionary and Soviet Russia," The Photographic Journal [Royal Photographic Society of Great Britain--London], No. 101 (May, 1961), pp. 129-148.

Christie, R. H. "Lasers in Photography," Perspective: Quarterly Review of Progress. Photography, Sound and Image Recording. Vol. VIII, No. 2 (1966).

Coe, B. W. "Eighty-Two Years of Scientific Photography," Discovery: The Magazine of Scientific Progress, Vol. XVII, No. 8 (August, 1956), pp. 332-338.

Coleman, K. R. "High-Speed Photography," Physics Bulletin [Great Britain], Vol. XX, No. 10 (October, 1969), pp. 405-408.

A review is given of past work and present applications. The use of light sources, shutters, and camera systems are discussed.

______. "Ultra-High-Speed Photography," Reports on Progress in Physics, Vol. XXVI, (1963), pp. 269-305.

Abstract: The region of ultra-high-speed photography can be taken as limited to photography with exposure times shorter than 50 microseconds. The instrumental methods used in this region are discussed. Photography is considered in its broadest sense, not limited to the visible region nor to the photo-chemical receptor. Hence not only are rotating-mirror cameras considered but also image tubes and flash x-ray tubes together with their applications in the topic.

Contents: 1. Introduction; 2. Shutters: Mechanical Shutters, Non-Mechanical Shutters, Repetitive Shutters at Extreme Speeds, Synchronization; 3. Light Sources: Gas Discharges, Spark Sources, Flash Bombs, the Optical Maser as a Light Source; 4. Flash Radiography, Field Emmission Tubes, Repetitive Flash; 5. Cranz-Schardin Photography; 6. Multiple Cameras; 7. Framing Cameras with Moving Film; 8. Rotating-Mirror Cameras: Continuous Access in Rotating-Mirror Driving Methods, Focal-Plane Shutters in Rotating-Mirror Cameras, Recent Advances in Streak Cameras using Rotating Mirrors, Performance and Efficiency of Rotating-Mirror Cameras, Time-Resolved Spectrographs (Mechanical); 9. Image Dissection Methods, Russian Work in Image Dissection, New Systems by Courtney-Pratt, Fibre Optics as an aid to Image Dissection; 10. Image Tubes as High-Speed Cameras, Image Tubes Designed for General Purposes, Image Tubes for High-Speed Recording; 11. Ultra-High-Speed Photography as a part of Physics, Dimensions of Records, Examples of Different Uses of Available Dimensions, The Choice of Exposure Time, Figures of Merit. Acknowledgments. References.

Collins, John R. "Infrared Radiometry," Electronics World, Vol. XVIII, No. 4 (October, 1967), pp. 23-27, and 69.

Everything above Kelvin zero emits heat that can be converted into infrared photographs by radiometers. These useful instruments find wide application in electronics, medicine, mechanical inspections and by the armed forces for locating camouflaged men and vehicles.

Compton, Robert D., ed. "Interferometry--The Young and the Old of it," Electro-Optical Systems Design, Vol. VI, No. 3 (March, 1974), pp. 23-27.

Real time interferometry, which provides a 3D display of the contours of an optical surface to a small fraction of a wavelength, is only one of the exciting developments in this old but dynamic field.

Cooper, G. R. "Developments in Scientific Motion Picture Photography," British Kinematography, Sound and Television (Great Britain), Vol. LIV, No. 5 (May, 1972), pp. 136-138.

Courtney-Pratt, J. S. "Advances in High-Speed Photography, 1957-1972," Journal of the SMPTE, Vol. XXCII, No. 3 (March, 1973), pp. 167-175.

_______. "A Review of the Methods of High-Speed Photography," Reports on Progress in Physics, Vol. XX (1957), pp. 379-432.

Abstract: p. 379. Contents: 1. Introduction; 2. Streak Records; 3. Single-Exposures; 4. Multiple Exposures; 5. Series of Separate Pictures; 6. Series of Pictures by Image Dissection; 7. Conclusions. References.

_______. "High-Speed Photography and Micrography," Applied Optics, Vol. III, No. 11 (November, 1964), pp. 12-1-1209.

_______., and Rentzepis, P. M. "Picosecond Photography and Time Resolved Spectrography," Journal of the SMPTE, Vol. XXCIV, No. 6 (June, 1975), pp. 478-480.

Cox, R. E., and Sinnott, R. W. "A Cold Camera That Needs no Vacuum," Sky and Telescope, Vol. L, No. 2 (August, 1975), pp. 122-124.

Dahlberg, E. Philip. "Instrumentation for Surface Analysis," R/D Research/Development, Vol. XXVI, No. 6 (June, 1975), pp. 16-18, and 20.

Dalton, Stephen. "The Fantastic World of Flying Insects," Popular Photography, Vol. LXXVII, No. 5 (November, 1975), pp. 96 [97-103--illustrations], 160, 186, 208, and 218.

Excerpts from Stephen Dalton's Book Borne on the Wind. A remarkable review of close-up photography in color of insects in flight with maximum sharpness and detail.

Davis, W. C. "Exposure-Limited Application of Kerr Cell Cameras," Applied Optics, Vol. III, No. 11 (November, 1964), pp. 1215-1216.

Delly, John Gustav. "Microscopy's Color Key: Chart Holds Answers to Particle Mysteries," Industrial Research, Vol. XV, No. 10 (October, 1973), pp. 44-50.

Delmare, Cl. "Time Function in High-Speed Photography," ONDE Electriques [Societe des Electriciens, Electroniciens et Radioelectriciens--SEE], Vol. L, No. 4 (April, 1970), pp. 309-312. [In French--Summaries in English and French].

Denisyuk, Yury N. "Holograph Motion Pictures," Soviet Physics--Technical Physics, Vol. XVII, No. 12 (June, 1974), pp. 1549-1551. [Russian Original--Vol. XLIII, No. 12 (December, 1973), pp. 2457-2629]. Trans. by American Institute of Physics, 1974.

The problems involved in the development of holographic motion-picture photography are discussed. One of the most probable directions is the development of cassette apparatus for individual use. A possible arrangement for image projection with this type of apparatus is discussed. The ultimate solution of the problem of developing holographic motion pictures requires the development of a method for reducing the size of the projected holograms while retaining the size of the screen and window through which the iamge is observed. Another equally important problem is the development of a method for constructing holograms carrying three-dimensional images from the information obtained from ordinary stereoscopic photography. (p. 1549) English Language Edition.

_______. "Holography, The Magic Tool," Soviet Weekly (London) No. 1795 (July 3, 1976), p. 16.

Denstman, Hal. "Basics of Photomacrography," Pt. I. Industrial Photography, Vol. XXIV, No. 5 (May, 1975), pp. 15-18.

Photomacrography bridges the gap between the relatively unsophisticated disciplines of normal close-range photography and the very demanding requirements of photomicrography. To the researcher, photographic technologist and industrial photographer, photomacrography should represent more than an obliquely interesting technique. It's a valuable method of

precision documentation, used when it's necessary to expand a subject's features beyond the capability of normal close-ups, but free of the coverage limitations associated with photography through the microscope. (p. 15).

_______. "Basics of Photomacrography," Pt. 2. Industrial Photography, Vol. XXIV, No. 6 (June, 1975), pp. 15-17, & 48.

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_______. "Close-ups with a Vertical Camera System," The Professional Photographer, Vol. CII, No. 1952 January, 1975), pp. 61-66. (P. 67, visuals).

Dolgoff, Eugene. "Special Report: Commercial Holography. Where Are You?" Optical Spectra. [The Magazine of Optical, Electro-Optical and Laser Technology], Vol. IX, No. 3 (March, 1975), pp. 26-31.

A brief diagnoses of what has happened in holography to date, and a prognoses for its future. (p. 26).

Dommashch, Hans S., et al. "Investigation into Techniques of Gait Analysis," Journal of the Biological Photographic Association, Vol. XL, No. 3 (July, 1972), pp. 106-116.

Dubovik, A.S., et al. "Illuminance of the image in the ultraspeed cameras SFR, ZhLV-2 and ZhFR-3," Zhurnal nauchnoi i prikladnoi fotografii i kinematografii, Vol. XXI, No. 1 (Jan-Feb, 1976), pp. 5-16. 9 references.

On the basis of the structural characteristics of their optical schemes, formulas are derived for the illuminance of the image in the streak camera (SFR), the high-speed slave-type camera ZhLV-2, and the slave photographic detector ZhFR-2, in both photographic detector and high-speed slow-motion variants.

Dudnikov, Yu. A. "On the Design of a Scheme for Producing Integral Photographs by a Combination Method," Soviet Journal of Optical Technology, Vol. XXXXI, No. 8 (August, 1974), pp. 426-429.

Dugger, P.H., and Hendrix, R.E. "Laser Photography: A Role at AEDC," Optical Spectra. Vol. IX, No. 5 (May, 1975), pp. 32-34. 5 references.

A pulsed ruby laser and a direct photographic system are used in various modes for in-flight measurement of contours of hypervelocity test models.

Duguay, Michel. "Light Photographed in Flight," American Scientist, Vol. LIX, No. 5 (Sep-Oct, 1971), pp. 550-556.

Dyer, Denzel L. "Optical Limits in TV Microscopy," Research/ Development, Vol. XXIV, No. 9 (September, 1973), pp. 40-44.

Automated TV-Microscope Systems for image analysis are often limited by effects within the microscope and other parts of the system. How to identify and avoid some major problem areas.

Dyring, Eric. "Little Things" (Trans. of "Det Lilla"), Forskning och Framsteg (Sweden), No. 3 (1976), pp. 53-56. [NASA TT-F-17092, June, 1976. Accession No. N76-27535. Springfield, Va.: NTIS, 1976. 7pp.

A brief discussion of advances in photographic techniques derived from the U.S. Space Programs.

Edgerton, Halold E., and Carson, John F. "Motion Picture Photomicrography with Electronic Flash," Applied Optics, Vol. III, No. 11 (November, 1964), pp. 1211-1214.

Elenevskii, D.S., et al. "Primenenie strobogolograficheskogo metoda dlya issledovaniya vibratsii" ("Use of a Stroboholographic Method for Vibration Studies"), Problemy Prochnosti [Vsesoyuznaya nauchno-tekhnicheskaya konferentsiya po konstruktsionoi prochnosti dvigatelei, 3rd, Kuibyshev, U.S.S.R., October 15-17, 1974], (May, 1976).

Stroboholography can be used to accurately determine the distribution of the amplitudes of the vibratory displacements of turbine blades. One Strobohologram can provide data on amplitude distributions for all vibration modes in the frequency range studied.

"Engineers Utilize Unusual Cameras," Technical Photography, Vol. III, No. 2 (February, 1971), pp. 1, and 10-11.

Utilization of such techniques as: Schlieren, Shadowgrams, Laser Experiments, Infrared Studies, X-Ray Photography and Support Equipment necessary to obtain required date in aerospace R & D programs at Arnold Engineering Development Center.

Essen, L. "New Orders of Accuracy," Discovery, Vol. XXVI, No. 1 (January, 1965), pp. 43-47.

Evdokimov, S.V., et al. "Primenenie lazerov dlya skorostnoy kinos'emki bystroprotekyushchikh protessov" ("The Use of Lasers for High-Speed Motion Picture Photography of Rapidly Occurring Processes"), Pribory i tekhnika experimenta (Sept-Oct, 1973), pp. 193-195.

Everest, F. Alton. "The Efficient Use of Light in Macrocinematography," Journal of the SMPTE, Vol. LXXI, No. 9 (September, 1962), pp. 664-667.

Exclusive Report. The Search for the Thresher. "Bathyscaph Makes First Visual and Photographic Contact," John V. Pflaum and Lutz Winkler; "Thresher Location Precisely Plotted by Use of Special Gear," Bill H. Mcada. Special Reprint from Industrial Photography (April, 1965).

Faerman, G.P., and Sheberstov, V.I. "Physical Chemistry of Photographic Development," Uspekhi nauchnoy fotografii ("Progress in Scientific Photography"), Vol. XV (1970), pp. 152-164. English Translation available as Accession No. AD 784 744. Springfield, Va.: NTIS, 1974.

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Fanaki, F. H., and Lesins, G. "Photographic Measurement of Smoke Plume Heights from Industrial Stacks," Journal of the SMPTE, Vol. XXCIV, No. 2 (February, 1975), pp. 77-81

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Described are a basic electronic flash and delay circuit and its applications to shadow and reflected-light photography, Kerr-Cell Shutters, and Ultra-High-Speed Cinematography in Conjurction with the Cranz Optical Setup (p. 603).

Feinberg, Gerald. "Light," Scientific American, Vol. CCXIX, No. 3 (September, 1968), pp. 50-59.

Fishcher, Heinz and Fritzsche, A. "Simple High-Speed Kinematography of Nanosecond Exposure," Applied Optics, Vol. III, No. 11 (November, 1964), pp. 1235-1236.

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Franz, Donald W. "Applications of Television in the Underwater Environment," Functional Photography, Vol. X, No. 6 (November, 1975), pp. 16-18, 23-24, and 35-36.

Friedman, Bernard and Nazarian, James H. "A Photomicrography Primer for Professional Photographers," Part I. Industrial Photography, Vol. XXIII, No. 10 (October, 1974), pp. 28-30, and 59-60.

______. "A Photomicrography Primer for Professional Photographers," Part II, "At Last," *Industrial Photography*, Vol. XXIV, No. 3 (March, 1975), pp. 20-21, and 65.

Frish, S. E. "Optics in the U.S.S.R. Academy of Sciences," *Applied Optics*, Vol. XIII, No. 10 (October, 1974), pp. A14-15, and 2446-2448.

A comprehensive review is given of the work and achievements of the Academy from its inception in 1724 to the present day, from the earliest days of microscopes and telescopes to recent work on the development of holography and the application of optical and spectral methods in space research.

Frolov, P. V., *et al.* [Moscow University, U.S.S.R.]. "A New Streak Camera FR-14 for Measurement of Burning Velocity," *Fizika, Goreniya i Vzryva* (USSR), Vol. VII, No. 1 (1971), pp. 158-159) [See *Combustion, Explosions and Shockwaves* USA for English Language Translation].

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Dr. Dennis Gabor demonstrates the principle behind new application of the laser to project three-dimensional movies.

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Ultra-slow motion macrophotography confirms new theory of what makes auto brakes squeal.

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Experiments were performed on high-speed motion picture

interferometry of a rapid process, using a UIG-1 pulsed holographic apparatus and an SFR-1 streak camera. The streak camera recorded the interference pattern obtained in real time by the UIG-1. Two frames, separated by 62 microsec, are presented showing successive stages in the development of a shock front due to the interaction between powerful laser radiation and a graphite target.

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Gorokhovski, Yu. N., and Kuznetsova, A. L. "Modulation Transfer Functions of the Photographic Material Developer System, Determined with a Bar Test-Object," Zhurnal nauchnoy i prikladnoy fotografii i kinematografii ("Journal of Scientific and Applied Photography and Cinematography"), Vol. XV, No. 3 (May-June, 1970), pp. 196-203.

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Groner, Warren. "Lasers," Electronics World, Vol. LXXIV, No. 2 (August, 1965), pp. 31-35, 63. illus.

The first of three authoritative articles on lasers; Covers all types of laser operation, application, and testing procedures. An authoritative explanation of the operation of solid and gaseous lasers. The Significance of such effects as coherence, population immersion, photon amplification and stimulated emission is made clear.

______. "Lasers; Practice and Applications," Electronics World, Vol. LXXIV, No. 3 (September, 1965), pp. 45-58, and 73-74.

Part II. Injection laser operation explained; pumping power-supply circuits and moduation and demodulation of laser beam are considered. Important applications are included.

______. "Laser Measurements," Part III. Electronics World, Vol. LXXIV, No. 5 (November, 1965), pp. 50-52, 67-68.

Equipment and procedures for testing laser performance measurement of pulse power, laser spectrum and modulation are included along with a discussion of safety considerations,

Gurevich, S. B., and Sokolov, V. K. "Maximum Information Capacity of a Holograph System," Zhurnal Tekhnicheskoi Fiziki, Vol. XLIII (March, 1973), pp. 675-678 [Academy of Sciences of the U.S.S.R., Physico-Technical Institute of Leningrad, U.S.S.R.]; Translated in Soviet Physics--Technical Physics, Vol. XVIII (September, 1973), pp. 424-426. 11 references.

Hall, Jeff. [Director Center of Holography, West Hartford, Conn.]. "Holography; Magic Cult or Photo Science?" Audio-Visual Communications, Vol. IX, No. 7 (July, 1975), p. 11.

Hanson, Peter P. "Silver Halide Photographic Systems--A Bibliography of Reviews (1960-1970)," Photographic Science and Engineering, Vol. X V, No. 6 (November-December, 1971), pp. 501-509.

Lists more than two-hundred review articles published during the past decade. Most citations were obtained from a search of Abstracts of Photographic Science and Engineering Literature.

______. "Unconventional Photographic Systems--A Bibliography of Reviews," Photographic Science and Engineering, Vol. XIV, No. 6 (November-December, 1970), pp. 438-442.

This paper provides a checklist of review articles dealing with nonsilver processes: Diazo, Electrographic, Photochromic, Photopolymer, Thermographic, and Vesicular Systems are covered.

Harrison, G. G. "Photography in the Service of Science," Photography Journal (London), 94A (August, 1954), pp. 197-199, and 202.

Hawkins, G. A., and Balleisen, C. E. "High-Speed Photography: Part I. External Surfaces and Opaque Objects," Machine Design, Vol. XIX, No. 8 (August, 1947), pp. 127-133.

How new techniques make it possible for designers to study and develop mechanism for operating speeds too fast for the eye to perceive.

______. "High-Speed Photography: Part II. Radiography and Motion Pictures," Machine Design, Vol. XIX, No. 9 (September, 1947), pp. 121-126.

Healey, Thomas J. "An Advanced Image Converter Diode for High-Speed Photography," High-Speed Ideas; Applications Newsletter from Beckman & Whitley, Inc., Vol. III, No. 2 (1965), 11pp. 27 references, illus.

Heiserman, David L. "Scanning Electron Microscopes," Electronics World, Vol. XXCV, No. 2 (February, 1971), pp. 42-44, and 52.

Hendrix, R. E., and Dugger, P. H. "Photographic Instrumentation in Hyperballistic Range (G) of the vonKarmen Gas Dynamics Facility," Photographic Applications in Science, Technology and Medicine, Vol. VIII, No. 5 (September, 1973), pp. 22-24, and 29-30.

Henley, D. R., et al. "A Hybrid System for Dynamic Photoelasticity," (Ultra-high-speed photography using a pulsed ruby laser and an acousto-optic beam deflector is described), Experimental Mechanics, Vol. XV, No. 8 (August, 1975), pp. 289-294. Includes 21 references.

Abstract: An ultra-high-speed camera utilizing an acousto-optic device for deflecting light rays is described. The system employs a pulsed-ruby-laser light source used in conjunction with a Cranz-Schardin-Type camera thus utilizing the best features of both systems for recording a sequence of photographs. The system has been demonstrated at framing rates of up to 200,000 frames/sec and has the potential for considerably faster operation.

It features the capability of producing a sequence of dynamic photographs in which the time between successive exposures can be independently varied. Thus, the frequency at which photographs are obtained can be increased during the times of greatest interest. Experimental results demonstrating these features are given.

Herman, R. W. "Photography Helps Develop Rockets and Guided Missiles," [Photographic Science and Techniques], PSA Journal, Section B, No. 12 (December, 1952), pp. 107-111.

_______. "Schlieren Mirror Photography," Photographic Applications in Science, Technology and Medicine, Vol. IX, No. 2 (March, 1974), pp. 26-34.

Herron, Robin E. "Exploring the Third Dimension with Camera and Computer," Kodak Studio Light, Issue No. 1 (1975), pp. 26-29.

Hey, Nigel. "Spectrum: Scientific Motion Picture Photography at Sandia Labs," Photographic Applications in Science, Technology and Medicine, Vol. IX, No. 5 (September, 1974), pp. 24-27, 33, 36, 40, and 42.

Hicks, J. Wilbur Jr., and Kiritsy, Paul. "Fiber Optics," The Glass Industry, Vol. XLIV, No. 4 (April, 1962), pp. 193-196, and 208-211.

_______. "Fiber Optics," The Glass Industry, Vol. XLIV, No. 5 (May, 1962), pp. 263-264, and 279.

A handbook on fiber optics in two parts provides a simplified approach to a field of growing importance. Includes an extensive list of books, periodicals and abstracts for further information on fiber optics.

Higgins, George C. "High-Speed Filming--Analysis Through Stop Action," Photographic Applications in Science, Technology and Medicine, Vol. VIII, No. 4 (July, 1973), pp. 24-26.

_______. "High-Speed Photography," Journal of Photographic Science," [London: The Royal Photographic Society of Great Britain], Vol. V, No. 2 (March-April, 1957), pp. 17-42.

_______. "Kodak Research Laboratories," Applied Optics, Vol. XI, No. 1 (January, 1972), p. 103.

_______. "Method for Engineering Photographic Systems," Applied Optics, Vol. III, No. 1 (January, 1964), pp. 1-10.

"High-Speed Photography," Applied Optics, Vol. III, No. 11 (November, 1970). [Issue Devoted to High-Speed Photography].

"High-Speed Photography Expands the Corridors of Time," Scientific Dimension [Canada], Vol. III, No. 6 (December, 1971), pp. 22-27.

"High-Speed Photography of Liquids," Strobotactics, Vol. IV, No. 1 (1970), pp. 5-6.

High-speed stroboscopic photography applied to numerous studies of fluid behaviour. R. Wayne Anderson, discusses techniques for producing scientific films that also have the sense of the dramatic.

Hirako, Yoshio. [University of Osaka Prefect Sakai, Japan, Ohta Motoo]. "Effect of Lean Pre-mixture on the Combustion in Diesel Engine," Bulletin JSME [Japan Society of Mechanical Engineers, Tokyo, Japan], Vol. XVII, No. 104 (February, 1974), pp. 256-263.

High-speed photography was used to make clear the influence of lean pre-mixture on the combustion in the cylinder. In this attempt, a 2-hole nozzle was used for main injection, main sprays were deflected in two directions at an angle of 50°. The pre-mixture was intentionally concentrated in one of the two main sprays, so that two different combustion processes with and without the pre-mixture could be compared under the same conditions. [4 references are included].

Hoff, F. "Opticka holografie" ("Optical Holography"), (Ceskoslovenska akademie ved, ustav radiotechniky a elektroniky, Prague, Czechoslvakia), Slaboproudy obzor, Vol. XXXVI (July, 1975), pp. 305-312. 2 references in Czech.

Available from IAA as Accession No. A75-43520#. International Aerospace Abstracts, Category 35, Instrumentation and Photography, Vol. XV, No. 21 (November 1, 1975), p. 3104.

The theoretical principles and practical applications of optical holography are reviewed. Phenomena associated with interference and diffraction of light are examined, along with some aspects of the reconstruction of wave fronts. The application of optical holography to the acquisition and processing of optical data for use in interferometry and radar technology is discussed.

Holm Wilton R. "Holographic Motion Pictures for Theatre and Television," American Cinematographer, Vol. LV, No. 4 (April, 1974), pp. 455, and 458-464.

Howell, J., and Macek, W. M. "Lasers," Discovery: The Magazine of Scientific Progress, Vol. XXIII, No. 9 (September, 1962), pp. 16-22.

The production of a pure and coherent form of light has been hailed as the most important technical innovation of the last three years. Opening up a completely new range of optical science, the laser is finding applications in fields as far apart as space communication and microsurgery.

Hyzer, William G. "Engineering Experiments," Pt. I. Single-Factor Experiments. Machine Design, Vol. XXXI, No. 12 (June 11, 1959), pp. 134-141.

A simplified approach to setting up and interpreting enginering experiments based on statistical methods.

_______. "Engineering Experiments," Pt. II. Multiple-Factor Experiments. Machine Design, Vol. XXXI, No. 13 (June 25, 1959), pp. 128-133.

Setting up and interpreting engineering experiments.

_______. "Hyzer on High-Speed: MP-4 Modifications and Accessories," Photomethods, Vol. XVII, No. 9 (September, 1974), pp. 20, 64-65, and 67.

_______. "Limits of Photography as an Instrument of Measurement," Photomethods, Vol. XVIV, No. 10 (October, 1976), pp. 40-42, and 60.

Photographic measurements usually fall into one of two broad categories: Spatial and Radiometric.

_______. "Measuring Motion with High-Speed Movies, Machine Design, Vol. XXXI, No. 7 (April 2, 1959), pp. 102-108.

_______. Notes on Photonics. "Film Readers," R/D Research/Development, Vol. XXIV, No. 12 (December, 1973), pp. 28, and 30-31.

What equipment should you consider when faced with the task of extracting information from photographic records? Here is what's available today in the field of film analyzers, how the instruments work, and what their capabilities are.

_______. Notes on Photonics. "High-Speed Photography," R/D Research/Development, Vol. XXIII, No. 8 (August, 1972), pp. 52, and 54-56.

_____. Notes on Photonics. "Infrared Materials--How to Use Them," R/D Research/Development, Vol. XXIII, No. 4 (April, 1972), pp. 58, and 60.

Infrared-sensitive emulsions, false-color film and liquid crystals are among the materials finding increased use in recording infrared images. Here are the techniques required to apply them successfully in photomicrography and other areas of scientific infrared photography. (p. 58).

_____. Notes on Photonics. "Instant Photography in the Laboratory," Part I. R/D Research/Development, Vol. XXIV, No. 2 (February, 1973), pp. 54-56.

Various instant film systems can be used to record laboratory events, but picking the right one may not be so easy. This first of two articles reviews the available systems--and also evaluates the merits of Polaroid's new SX-70 camera. (p. 54).

_____. Notes on Photonics. "Instant Photography in the Laboratory," Part II. R/D Research/Development, Vol. XXIV, No. 4 (April, 1973), pp. 60, and 62.

This last of two articles discusses some unique applications--such as mapping acoustic fields--for instant photography. Also provided are helpful hints, including prefogging, and chilling of film, for getting the most effective results. (p. 60).

_____. Notes on Photonics. "Laboratory Telescopes," R/D Research/Development, Vol. XXIV, No. 8 (August, 1973) pp. 58, 60-61.

_____. Notes on Photonics. "Lens Testing," R/D Research/Development, Vol. XXIV, No. 6 (June, 1973), pp. 77-78, 80-81.

Definition, resolving power, sharpness, acutance, granularity, spread function and MTF value are key factors when evaluating an optical system's image-forming capability. Here's practical information on how they can help ensure optimum lens performance.

_____. Notes on Photonics. "Microscopy--Optical and/or SEM," R/D Research/Development, Vol. XXIII, No. 6 (June, 1972), pp. 51-52, and 54.

_____. Notes on Photonics. "Particle Measurement," R/D Research/Development, Vol. XXVI, No. 4 (April, 1975), pp. 50, 52, 54, 56. (contains 15 references).

______. Notes on Photonics. "Photographic Information: Where and How to Get It," R/D Research/Development, Vol. XXVII, No. 8 (August, 1976), pp. 68-71. [34 References]

______. Notes on Photonics. "Photography: Macro or Micro?" R/D Research/Development, Vol. XXVI, No. 6 (June, 1975), pp. 22-25. [8 References].

For low-magnification photography, you can use a microscope or standard camera lenses; Here's how to make the choice.(p.22).

______. Notes on Photonics. "Sensitivies of Photographic Materials," R/D Research/Development, Vol. XXVI, No. 7 (July, 1975), pp. 28-31. [15 References].

______. Notes on Photonics. "Taking Stereo Photos in the Laboratory," R/D Research/Development, Vol. XXIII, No. 12 (December, 1972), pp. 51-52, 54, and 56.

Expensive, highly specialized equipment is not necessary to make stereoscopic recordings. Here are some simple approaches--along with ideas for applying the technique in laboratories.

______. Notes on Photonics. "Thermomicrography," R/D Research/Development, Vol. XXIII, No. 2 (February, 1972), pp. 61-62, and 64.

Although infrared scanning cameras for real-time thermography are not new, the techniques have only recently been extended to microscopy. Here is how the system works, how it is used, and what kind of data are being obtained. (p. 61).

______. Notes on Photonics. "Time-Lapse Photography in the Laboratory," R/D Research/Development, Vol. XXIV, No. 10 (October, 1973), pp. 74-75.

Some phenomena occur too slowly for the eye to analyze, but proper photographic equipment and technique make it possible to collect data that permit precise analysis. (. 74).

______. "Optimum Techniques of High-Speed Cinematography," R/D Research/Development, Vol. XXVI, No. 2 (February, 1975), pp. 64-66, and 68. [11 References].

What is the best way to take motion pictures of rapidly-occurring phenomena? This article tells how to select a camera, explains the methods and mathematical techniques involved, and tells how to optimize their application.

______. "Optimum Techniques in Photomacrography," Photomethods, Vol. XVIII, No. 2 (February, 1975), pp. 25-29 and 44.

Successful photomacrography depends upon the photographer's

ability to compromise effectively in selecting the conditions of photography.

Photography is practiced as both an art and a science; but when it comes to photomacrography, a comprehensive knowledge of its scientific fundamentals is almost essential if consistent results of high quality are to be obtained. (p. 25).

______. "Photomicrography (Think Small)," *Photomethods*, Vol. XVIII, No. 10 (October, 1975), pp. 19-22.

Results in microscopy--as in photography--depend more on the skill of the person in control than on the instrument itself.

This article is written primarily for readers with skills in photography who have a special interest in photomicrography or who have inherited the responsibility of producing photomicrographs but do not have the required tenure of experience to work proficiently and confidently in the field. (p. 19).

______. Scientific Instrumentation: Hyzer on High-Speed. "Computational Aids--Slide Rule and Electronic--Can Aid the Scientific and Industrial Photographer," *Photomethods*, Vol. XVII, No. 2 (February, 1975), pp. 20, 56-57.

______. Scientific Instrumentation: Hyzer on High-Speed. "A New and 'Cool' Incandescent Ring Light: Rental Sources and Photoconsultants," *Photomethods*, Vol. XVII, No. 3 (March, 1975), pp. 46-48.

______. Scientific Instrumentation. "Optimizing the Image/Observer Relationship," *Photomethods*, Vol. XVIII, No. 9 (September, 1975), pp. 8, 10, and 12.

Optimum viewing conditions are based on several characteristics of the human eye, namely, i) contrast acuity, ii) detail acuity, iii) vernier acuity, and iv) motion acuity. These and other characteristics of the human eyes are discussed by Smith [1] [Warren J. Smith in *Modern Optical Engineering*, New York: McGraw-Hill Book Company, 1966, Chapter 5], in terms of interest to the optical engineer. We will limit our discussion here to 16mm cine images viewed and analyzed by projection. (p. 8).

______. "Some Practical Considerations in the Analysis of High-Speed Motion-Picture Data," *Journal of the SMPTE*, Vol. LXVI, No. 6 (June, 1957), pp. 357-360.

The usefulness of motion-picture images for both visual and quantitative analysis depends on several factors, including optical resolution, image blur, image contrast, image-shape characteristics, and differented movement of the image

from frame to frame. These factors were evaluated in a series of practical tests, using standard analytical techniques and equipment to determine their effects on the overall performance of 16 mm films. illustrated. (7 References).

______. "Underwater Recording," R/D Research/Development, Vol. XXIII, No. 10 (October, 1972), pp. 46-47, 49-52.

Distortion, chromatic aberration and limited visibility are major obstacles in underwater photographic recording. Here is advice on how to cope with these--and some of the special equipment that can be used--in the lab and at sea.

______., and Mosbacher, C.J. "Photography in R and D," R/D Research/Development, Vol. XXVI, No. 12 (December, 1975), pp. 20-22.

How much is photography used as an R & D tool? What for? What equipment and services are used now? Next Year? An R/D Survey answers these and other questions.

"In-Flight Stop-Motion Flash Photography," British Journal of Photography," [Great Britain], Vol. CIX, No. 12 (March 24, 1972), pp. 254-256.

Ingram, David. "Spectra in the Microwave Region," Discovery, Vol. XXIII, No. 2 (February, 1962), pp. 29-35.

"Instruments Getting Closer to the Speed of Light," Industrial Research, Vol. XV, No. 2 (February, 1973), p. 29.

Itek Corporation. "Skylab Earth Resources Photography," Photomethods, Vol. XVII, No. 9 (September, 1974), pp. 38-39.

Itzkan, I. "Guest Editorial: Optical Engineering at AVCO-Everett Research Laboratory," Optical Engineering: The Journal of the Society of Photo-Optical Instrumentation Engineers, Vol. XIII, No. 2 (March-April, 1974), pp. 74-78.

This issue also includes five papers written by various authors from AVCO-Everett Research Laboratory.

Jackson, H. Ross. "Tutorials: Natural Science Photography," Part III. "Laboratory Procedures" (continued). Journal of the Biological Photographic Association, Vol. XL, No. 3 (July, 1972), pp. 124-162. [See previous issues for Part I and II of this tutorial].

James, T. H., and Hamilton, John F. "The Photographic Process," International Science and Technology, No. 42 (June, 1965), pp. 38-44, and 85.

Jantzen, Charles A. [Photographic Analysis Company, as told to Arthur H. Rosien]. "Photo-Instrumentation: Modern Techniques and Applications of High-Speed Motion Picture Photography," Part 1. ". . . As American as Apple Pie!" Industrial Photography, Vol. XVIII, No. 3 (March, 1969), pp. 30-31, 36, 38, 40, and 42.

History of high-speed motion picture camera development is presented. American rotating prism camera is highlighted.

______. "Modern Techniques and Applications of High-Speed Motion Picture Photography," Part 2, "...Like Ham and Eggs," Industrial Photography, Vol. XVIII, No. 4 (April, 1969), pp. 32-33, and 71-75.

Operation of rotating prism high-speed motion picture camera is outlined and several photographic applications are listed.

______. "Photo-Instrumentation: Modern Techniques and Applications of High Speed Motion Picture Photography," Part 3, "Hot, Punchy Light," Industrial Photography, Vol. XVIII, No. 5 (May, 1969), pp. 38, 40, 42, 98-99, and 103-107.

Commercially available artificial light sources for high-speed motion picture photography are described: Safety precautions to be observed when using these lights are discussed; Characteristics of motion picture film Recommended for high-speed use are listed.

______. "Modern Techniques and Applications of High Speed Motion Picture Photography," Part 4, "Lenses and Frame Speeds," Industrial Photography, Vol. XVIII, No. 6 (June, 1969), pp. 32, 39, 73-74.

______. "Modern Techniques and Applications of High Speed Motion Picture Photography," Part 5, "Exposure Meters," Industrial Photography, Vol. XVIII, No. 7 (July, 1969), pp. 28, 30, and 32.

______. "Modern Techniques and Applications of High Speed Motion Picture Photography," Part 6, "Data Analysis," Industrial Photography, Vol. XVIII, No. 8 (August, 1969), pp. 28, and 30.

______. "High-Speed Oscillography," Industrial Photography, Vol. XX, No. 10 (October, 1971), pp. 26-27, and 38.

Oscillography used with high-speed rotating prism cameras gives pictures of high-speed phenomana, oscillo-streaks of high-speed phenomena, and dimension/time references.

Jatteua, M. "Infra-Red Thermography Equipment for Medical Applications," Philips Technical Review, Vol. XXX, No. 8/9/10 (August/September/October, 1969), pp. 278-289.

Jensen, N. "High Speed Image Analysis Techniques," Photogrammetric Engineering, Vol. XXXIX, No. 12 (December, 1973), pp. 1321-1328. (12 References).

Johnson, W.O.S. "High-Speed Photography in the Chemical Industry," Journal of the SMPTE, Vol. LXI, No. 5 (November, 1953), pp. 619-623.

______. "Rapid-Starting High-Speed Cameras," Journal of the SMPTE, Vol. LXIX, No. 7 (July, 1960), pp. 485-488.

Kahl, Fritz O. "Fiber Optics in Electronics," Electronics World, Vol. LXXIII, No. 5 (May, 1965), pp. 25-28, 77-78.

Optical fibers efficiently transmit light and images around bend and in controlled paths. This article surveys state of the art; the operating principles and characteristics; some current and potential applications in electronics field.

Kapany, N.S. "Fiber Optics," Scientific American, Vol. CCIII, No. 5 (November, 1960), pp. 72-81.

______. "Role of Fiber Optics in Ultra-High-Speed Photography," Journal of the SMPTE, Vol. LXXI, No. 2 (February, 1962), pp. 75-81.

Karnaukhov, V. N., et al. "Ob'emnyigolograficheskii fil'm, sintezirovannyi na TsVM" ("Three-Dimensional Holographic Films Synthesized by Means of a Digital Computer"), Pisma v zhurnal tekhnicheskoi fiziki, Vol. II, No. 4 (February 26, 1976), pp. 169-172. [In Russian].

Katz, Amrom H. "Introduction to Photographic Instrumentation Engineering," R/D Research/Development, Vol. XI, No. 6 (June, 1960), pp. 16, 18, 20-22, and 24-25.

Kersler, Thomas J., and Hill, William G. "A Color Schlieren System," Photographic Applications in Science, Technology and Medicine, Vol. IX, No. 1 (January, 1974), pp. 22-24, & 34.

Kho, Yam O., and Bäer, Johannes. "Flourescence Microscopy in Botannical Research," Zeiss Information, No. 76 (August 15, 1971), pp. 54, and 57.

Kilpatrick, David. "The Camera Does the Rest," New Scientist, Vol. LXVIII, No. 975 (November 13, 1975), pp. 378-381.

King, J., et al. "Infrared," International Science and Technology, No. 16 (April, 1963), pp. 26-37.

Kingslake, R., et al. "Optical Design at Kodak," Applied Optics, Vol. XI, No. 1 (January, 1972), pp. 50-53.

Klass, Philip J. "Avionics. Exclusive Report on Infrared. Pt. I. Infrared Challenges Radar's Monopoly," Aviation Week, Vol. LXVI, No. 9 (March 4, 1957), pp. 50-61.

______. "Avionics. Exclusive Report on Infrared. Pt. II. IR System Designer Faces Many Hurdles," Aviation Week, Vol. LXVI, No. 10 (March 11, 1957), pp. 78-79, 81, 83-85, 89, and 91-92.

Klosevych, Stanley. "Tutorials: Microscopy and Photomicrography," Pt. I. Journal of the Biological Photographic Association, Vol. XLII, No. 3 (July, 1974), pp. 123-131.

______. "Tutorials: Microscopy and Photomicrography," Pt. II. Journal of the Biological Photographic Association, Vol. XLII, No. 4. (October, 1974), pp. 147-160.

Komar, V.G., and Petrov, V.D. "Recording of Holographic Motion Pictures by the Slit Method," Tekhnika kino i televideniya ("Cinema and Television Techniques"), No. 8 (August, 1974), pp. 15-21.

A method of recording holographic motion pictures with the help of two symmetrically located slits is suggested permitting recording in encounter beams and reconstruction in white light.

Komelkov, V. "High-Speed in the USSR," Industrial Photography, No. 8 (August, 1959), pp. 28, and 49.

Kozhushko, A.A., and Ioffe, A.F. "Schlieren Method for High-Speed Streak Photography," Soviet Physics--Technical Physics, Vol. XX, No. 6 (1975), pp. 810-811.

An apparatus is described for visualizing perturbations in optically transparent media through photography with a motion picture camera and a system for separating the light beam.

______., and Miroshnichenko, V.I. "Streak Photography with a Color Schlieren System," Pis'ma v zhurnal tekhnicheskoi fiziki. Vol. 1 (April 26, 1975), pp. 378-381. [Soviet Technical Physics Letters, Vol. 1 (April, 1975), pp. 177-178, 6 references. English Trans.].

Describes a color schlieren system that has been employed in conjunction with a SFR high-speed moving image camera to investigate shock waves produced during the breakdown of plexiglass by a high voltage electric pulse.

Kragiel, H. H. "Equipment, Processing, Design--Expand Applications of High-Speed Photography," The Iron Age, Vol. CLXXV (April 7, 1955), pp. 126-128.

Krause, Earl E. "The Hologram," PSA Journal, Vol. XXXII, No. 6 (June, 1966), pp. 41-45.

Krolak, L.J., et al., "Fiber Optics--A New Tool in Electronics," Journal of the SMPTE, Vol. LXIX, No. 10 (October, 1960), pp. 705-710.

Krzeczkowski, S., and Wnuczak, E. "Design of a High-Speed Film Camera," ("Konstrukcja kamery do azybkiej kinematography"), Instytut Maszyn Przeplywowych. Prace. No. 64 (1974), pp. 135-146. (5 References in Polish).

Referenced in International Aerospace Abstracts, Vol. XIV, No. 23 (December 1, 1974), Cat. 14, p. 320. A74-4480.

Kutkin, I. A., et al. "Rapid Filming of the failure process in polymer materials," Zhurnal nauchnoi i prikladnoi fotografii i kinematografii, Vol. XXI, No. 1 (Jan-Feb, 1976), pp. 46-47. In Russian.

It has been demonstrated that high-speed cinema photography can be used to investigate the processes of dynamic failure in materials with high elasticity.

Lamberts, R. L., and Higgins, G.C. "Recording Digital Data on Photographic Film," Research/Development R/D, Vol. XVIII, No. 8 (August, 1967), pp. 24-25.

Landre, J. K. "Accelerating the Camera," Perspective. [Quarterly Review of Progress, Photography, Sound and Image Recording] Vol. VIII, No. 1 (1966), pp. 35-50. 52 References.

Modern developments on high-speed cameras have extended limits of mechanical and optical velocity. A senior camera project engineer here reviews recent designs and trends.

"Laser Optical Lever System," Industrial Photography, Vol. XX, No. 10 (October, 1971), pp. 20-21, and 36-37.

High-speed photography coupled with a laser optical system is an advancement in . . . monitoring rocket motion.

Laverents, Sidney N. "Cine Section: Macrophotography," PSA Journal, Vol. XXXII, No. 5 (May, 1966), pp. 31-34.

Lavrent'yev, V.I., and Podval'nyi, S.P. "The Determination of the Optimal Frame Frequency for High-Speed Motion Picture Photography," Zhurnal nauchnoi i prikladnoi fotografii i kinematografii, Vol. VI, No. 5 (Sept-Oct, 1961), pp. 349-352.

Leduc, M. "Development and Potential of High-Speed Photography using Electronics Systems," ONDE Electrique [Societe des Electriciens, Electroniciens et Radio-electriciens--SEE], Vol. L, No. 4 (April, 1970), pp. 282-285.[In French].

LeGrand, Rupert. "How Photography Helps Production," American Machinist, Vol. XCI, No. 12 (June 5, 1947), pp. 101-116.

Leith, Emmett N. "Holography--Lensless 3-D Photography," Industrial Research, No. 8 (August, 1966), pp. 40-43.

_______. "White Light Holograms," Scientific American, Vol. CCXXXV, No. 4 (October, 1976), pp. 80-88, & 92-95.

New Hologram can be viewed without coherent laser light or even quasi-coherent sources.

_______., and Upatnieks, Juris. "Photography by Laser," Scientific American, Vol. CCXII, No. 6 (June, 1965), pp. 24-35.

The highly coherent light produced by the laser is used in a novel photographic process in which light-sensitive film instead of recording an image, en effect records the light waves themselves.

_______. "True 3-D Image from Laser Photography," Electronics World, Vol. LXXIV, No. 4 (October, 1965), pp. 34-34, & 58-59.

It is now possible to create three-dimensional pictures with a lenseless camera and projector, and without the use of special optical devices such as tinted glass or screens.

Leonard, Milt [Associate Editor]. "Freezing the Fleeting Malfunction with High-Speed Photography," Machine Design, Vol. XLIV (October 5, 1972), pp. 107-111.

"Stymied by a malfunction that happens too fast to be seen? Then you might consider adding high-speed photography to your R & D tool bag. The modern instrumentation described here can be handled by a nonexpert."

Lewis, Ralph. "Multi-Flash Trigger Unit," Wireless World, Vol. LXXIX, No. 1457 (November, 1973), pp. 529-532.

Instrument triggers up to five flashunits at intervals from 11-ms to 11-s.

Li, Norman L., and Crow, Dennis L. "Photo-Instrumentation: Liquid Membrane Research," Industrial Photography, Vol. XX, No. 6 (June, 1971), pp. 34,48, and 54.

High-speed photography, plus macro and micro coverage was used to give visual documentation to the formation and breakup of drops in unique separations of fluid mixtures.

Lockie, D. "Fiber Optics--Primed for Take-Off," Electro-Optical Systems Design, Vol. VIII, No. 10 (October, 1976) pp. 30-34.

Fiber optics technology promises to do in the late 1970s what microprocessors did in the early 1970s--revolutionize electronics.

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There is also much interest in using the TV cameras for observation of natural polar aurora over Tiksi Bay. Rare photographs have been taken of rapidly moving aurora with a temporal resolution much greater than was possible before. They have made it possible to establish the actual speeds of rapidly moving particles, revealing the very nature of the process of entry of solar corpuscles intothe polar ionosphere.

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JOURNALS AND PERIODICALS

SECTION II

USPEKHI NAUCHNOY FOTOGRAFII

["PROGRESS IN SCIENTIFIC PHOTOGRAPHY"]

A SOVIET JOURNAL

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["PROGRESS IN SCIENTIFIC PHOTOGRAPHY"]

A SOVIET JOURNAL

Akademiya nauk sssr. Otdeleniye khimicheskikh nauk, Kommissiya po nauchnoy fotografii i kinematografii. ("Academy of Sciences of the U.S.S.R. Department of Chemical Science. Commission for Scientific Photography and Cinematography"). Uspekhi nauchnoy fotografii. Tom 1. Strukturnye i fotokhimicheskiye svoistva galoido-serebryanykh svetochuvstvitel'nykh sloev. ("Progress in Scientific Photography"), Volume 1 ("The Structure and Photochemical Property of Silver Halide Light Sensitive Emulsion Layers"). Chief editor, Corresponding Member of the Academy of Sciences of the U.S.S.R., K.V. Chibisov. Editorial Board: Associate Member of the Academy of Sciences of the U.S.S.R., T.P. Kravetz, Professor Ye. M. Goldovskiy, Professor Yu. N. Gorokhovskiy, Professor P.V. Kozlov, Dr. of Technical Science P.G. Tager, and Professor G.P. Faerman. Moscow: Izd-vo, Akademii nauk sssr ("Academy of Sciences of the U.S.S.R.") 1951. 243pp.

The Commission for Scientific Photography and Cinematography was established in 1948 in the sytsem of the Academy of Sciences of the U.S.S.R. under the Department of Chemical Science. One of the tasks of this Commission was to unite the various scientific establishments, enterprizes, and people--the workers in the various areas for the realization of a mutual exchange of information on a variety of scientific-and-technical questions related to the use of the photographic method. The Commission has all along organized a series of important scientific discussions and conferences, which only partly achieved the indicated tasks so highly necessary for the progress of the national [Soviet] scientific photography and cinematography.

The most effective means for the dissemination of information was considered to be by publication in journals. Therefore with this edition, the Committee began to publish the collected works entitled Uspekhi nauchnoy fotografii ("Progress in Scientific Photography"). By the publication of this journal the Commission intended to expand its overall information activities in addition to providing a forum for its own works developed in the area of scientific photography and cinematography. The future collections were envisioned as being

thematic in character and with the expectation of publishing compilations of appropriate select materials on the subject.

This first collection is devoted to the examination of the structure and photochemical properties of light sensitive emulsion layers. The first section includes materials surveying the character of the history and advancements of silver halide photographic materials, classifies their structural properties and the contemporary conditions related to questions of the latent photographic image. Other articles include experimental works in the area of two fundamental problems of the photographic method--the structural properties of light-sensitive materials and the mechanism necessary for the formation of the latent photographic image.

This collection includes reports previously read before the Plenary Session of the Commission for Scientific Photography and Cinematography of the Academy of Sciences of the U.S.S.R. The reports in the first half of this collection were presented March 17-19, 1949, in Moscow, the second section contains reports presented in Leningrad from June 23-25, 1949.

Contents:

Section II

The Nature of Light Sensitivity and Mechanism Necessary for the Formation of the Latent Photographic Image.

. Uspekhi nauchnoy fotografii. Tom II. Nauchno-tekhnicheskiye voprosy tsvetnoy fotografii i kinematografii; Fotograficheskaya zapis'; Iz istorii otechestvennoy fotograficheskoy nauki i tekhniki. ("Progress in Scientific Photography"). Volume II. ["Scientific-Technical Problems of Color Photography and Cinematography; Photographic Sound Recording; From the History of the Homeland (Domestic) Photographic Science and Technology"). Editorial Board: Corresponding Member of the Academy of Sciences of the U.S.S.R. K. V. Chibisov (Chief Editor), Candidate of Chemical Sciences V. I. Sheberstov (Assistant Chief Editor), Corresponding Member of the Academy of Sciences of the U.S.S.R. T. P. Kravets, Professor Ye. M. Goldovsky, Professor YU. N. Gorokhovskiy, Professor P. V. Kozlov, Candidate of Technical Sciences V. Ya. Mikhaylov, Professor P. G. Tager, and Professor G. P. Faerman. Moscow: Izd-vo, Akademii nauk sssr ("Academy of Sciences of the U.S.S.R.") 1951. 252pp.

The second volume of Progress in Scientific Photography--is primarily related to three specific areas of endeavour--Part I. concerns the Scientific-Technical Problems of Color Photography and Cinematography; Part 2. is devoted to the problems of photographic sound recording and Part 3. presents several materials from the history of the domestic photographic science and technology.

The articles devoted to questions of color photography are reports previously delivered at the Conference on Color Photography and Cinematography at the Academcy of Sciences of the U.S.S.R. in Moscow from October 23-27, 1950. The materials devoted to the questions of Photographic Sound Recording are reports given at a discussion in Leningrad from June 26-28, 1950--also organized by the Commission.

The collection begins with a short review of the history of the development of color photography. Two works are then included which relate to chemical-optical sensitization and components of color processes, that are primarily required to make up the component parts of the multi-layer photographic materials. Four works are devoted to color development processes by which we obtain the formation of the dye-color image.

The problems related to sensitometry for color:multilayer color photographic materials and processes is considerably more complex by comparison to sensitometric requirements of common black-and-white photographic emulsions--this is further expolored in seven reports. Two works are devoted to methods of the duping process of color motion picture negatives and light equipment for printing color motion picture films--these problems are of great significance for the further technology of producing color film prints (copies). In addition to questions of color photography the perception of color in motion picture films was also

discussed.

The second section is primarily devoted to problems of sound recording--a complex problem which is considered highly significant for cinematography in that without the development of sound we would still be back in the time of the silent films. Selections include discussions on the various systems of modulating light, construction of modulators for sound recording in cinematography, the development of apparatus for recording sound and recording sound on narrow guage films.

Section three is devoted to questions of the development of Soviet photographic scientific technology. Two reviews are included of the Scientific-Photographic activities of the Soviet centers containing the largest groups working in the field of scientific photography--Moscow and Leningrad. Two articles are devoted to the creative achievements and priorities of Russian as in the monograph by S.O. Maksimovich and the work of V.V. Lermantov in the area of processing and the latent photographic image during the past quarter of a century.

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______. IV. Resolving Power of Color Photographic Materials. p. 131.

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Yu. Sh. Moskovskiy. The Works of V.V. Lermantov in the Area of the Theory of Photographic Processing and Photo Chemistry. p. 245.

______. Uspekhi nauchnoy fotografii. Tom III. Priroda svetochuvstvitel'nosti i skrytoye fotograficheskoye izobrazheniye; Opticheskaya sensibilizatsiya fotograficheskikh sloev; Protsess fotograficheskogo proyavleniya. ("Progress in Scientific Photography"). Volume III. ("The Nature of Light Sensitivity and the Latent Photographic Image; Optical Sensitization of Photographic Emulsion Layers; The Mechanism of Photographic Development"). Editorial Board: Corresponding Member of the Academy of Sciences of the U.S.S.R., K.V. Chibisov (Chief Editor), Professor Yu. N. Gorokhovsky (Assistant Chief Editor), Corresponding Member of the Academy of Sciences of the U.S.S.R., T.P. Kravets, Professor Ye. M. Goldovsky, Professor P.V. Kozlov, Candidate of Technical Sciences V. Ya. Mikhaylov, Professor P.G. Tager, Professor G.P. Faerman, Candidate of Chemical Sciences V.I. Sheberstov. Moscow: Izd-vo, Akademii nauk SSSR, 1955. 220pp. illus.

This third volume in the publication Progress in Scientific Photography was prepared from lectures given at the Sixth All-Union Conference on Scientific Photography which met in Odessa during June 29 - July 4, 1951.

If we examine the history of the Conference on Scientific Photography we find that three Conferences were held prior to the Great Patriotic War (World War II) and three were held since the end of the war. The first Conference was conducted in November, 1932 at the Leningrad State Optical Institute. This Conference was devoted to the complex problems of scientific photography and the cinema-photography industry.

The Second Conference was organized in Moscow during October, 1937 by the Chemical Group of the Department of Technical Science of the Academy of Sciences of the U.S.S.R., and it reviewed problems of the chemical-photographic industry.

The Third Pre-War Conference was again conducted by the State Optical Institute during April, 1941 in Leningrad and was concerned with the task of reviewing scientific and applied problems of light sensitive photographic materials.

The three Post-War Conferences were organized by the Commission for Scientific Photography and Cinematography of the Academy of Sciences of the U.S.S.R. which was created in 1948, by the Department of Chemical Sciences of the Academy of Sciences, U.S.S.R., on the initiative of Academician S.I. Vavilov. The fourth Conference was conducted in Moscow in 1949 and was devoted to the review of scientific and technical applications of photography and cinematography. The fifth was also conducted in Moscow in 1950 and was devoted to a discussion of a wide circie of questions related to the complex problems of color photography. The sixt Conference was conducted in Odessa within the confines of the Odessa State University in the name of L.I. Mechnikov and was devoted to a discussion of the fundamental problems of scientific photography based on the

technology of the photographic method including the area of cinematography. Discussions were devoted to the fundamental problems related to the nature of light sensitivity and latent photographic image, the optical sensitivity of photographic emulsion layers and the process of development.

From this short review of the previous conferences it is easy to see the wide circle of questions which were discussed at each conference, which has been gradually narrowed down to specific questions to be devoted at particular conferences.

The highly outstanding contemporary achievements in the areas of physics and chemistry has guided the direction of Soviet photographic science for the past 25 years. The areas of knowledge has become so great during recent years that it is impossible to review all materials at any one conference. Therefore Conferences have been implemented so that an opportunity will exist to explore specific questions in much greater detail than otherwise possible. At the VI All-Union Conference many problems were discussed, the principle questions of which require a need for detailed discussions.

Contents:

Section 3

THE PROCESS OF PHOTOGRAPHIC DEVELOPMENT

Shiskina computed the composition of development baths which gave constant results independent of temperature.

Experiments were conducted in which a silver image was brought into contact with a photographic layer which was impregnated with developer when these layers were developed, this showed that silver bromide had been dissolved in places of contact with the image, and the image had become intensified.

________. Uspekhi nauchnoy fotografii. Tom. IV. Fotograficheskaya sensitometriya; Khimiko-fotograficheskaya obrabotka svetochuvstvitel'nykh materialov. ("Progress in Scientific Photography"). Vol. IV. ("Photographic Sensitometry; Chemical-Photographic Processing of Light Sensitive Materials"). Editorial Board: Corresponding Member of the Academy of Sciences of the U.S.S.R., K.V. Chibisov (Chief Editor), Candidate of Chemical Sciences, V. I. Sheberstov (Assistant Chief Editor), Corresponding Member of the Academy of Sciences of the U.S.S.R., T. P. Kravetz [Deceased], Professor Ye. M. Goldovskiy, Professor Yu. N. Gorokhovskiy, Professor P. V. Kozlov, Candidate of Technical Sciences V. Ya. Mikhaylov, Professor P.G. Tager, Professor G.P. Faerman. Moscow: Izd-vo, Akademii nauk sssr ("Academy of Sciences of the U.S.S.R."), 1955. 328pp. illus.

Volume IV, Progress in Scientific Photography is devoted to questions of Photographic Sensitometry (1st Part), and to questions of Chemical-Photographic Processing of Light Sensitive Materials (Part 2). The first section fundamentally contains reports on the sensitometry of black-and-white photographic materials, delivered at discussions organized by the Commission for Scientific Photography and Cinematography of the Academy of Sciences, U.S.S.R., and conducted in Leningrad from January 26 - 28, 1953. The second section is devoted to Processes of Chemical-Photographic Processing of Light Sensitive Materials delivered at the Conference conducted by the Commission in Moscow from February 19 - 23, 1954.

Section 1: PHOTOGRAPHIC SENSITOMETRY

The first article on Photographic Sensitometry by S.S. Gilyev is devoted to experiments introduced into the industry of the Soviet sensitometric systems GOST [State Standard] 2817-50, and its pecularities. pp. 7 - 16. The next five articles discuss various aspects related to important problems of sensitometry: G.A. Istomin. Reproduction of fine close-up details of light sensitive layers. pp. 17-22; G.A. Istomin. Comparative evaluation of various criterian of light sensitive photographic materials for solution to exposure meter problems, pp. 23-28; V.M. Bakhvalov and Yu. N. Gorokhovskiy. Sensitometric study of multilayer color photographic materials. V. Criterian of light sensitivity of color photographic materials. pp. 29-43; V.I. Sheberstov. Study of the relationship between the magnitude of light sensitivity and contrast of photographic layers, pp. 44-53; V.G. Pell'. Control of illumination for motion picture photography, pp. 54-60; V. Ya. Mikhaylov. Sensitometric control of photographic images under field conditions, pp. 61-66; V.A. Korndorf. On measurements of optical densities and the scatter of light by blackened surfaces of developed materials, pp. 67-81.

S.S. Gilyev, et al. The wedge-type photo-electric densitometer, pp. 82-87; A.T. Ashcheulov, T.A. Pavlichuk and M.D. Khukhrina. On the dependence of the resolving power of photographic materials upon the lens opening [aperture], pp. 88-105; A.T. Ashcheulov and M.D. Khukhrina. Investigation of the resolving power of photographic materials in the visible and ultra-violet regions of the spectrum by an interference method, pp. 106-110; I.I. Breido. Contact print method of determination of the resolving power of photographic materials, pp. 111-116; Yu. N. Gorokhovskiy and B.M. Levin. Projection granulometer--Instrument for measuring of Macro-graininess of photographic densities, pp. 117-126.

Section 2. Chemical-Photographic Processing of Light-Sensitive Materials.

The second section contains several articles devoted to the theory on the more important contemporary national problems to the processes of treatment, i.e., photographic development. The authors review the chief standards and problems of the mechanism of the kinetics of development.

G.P. Faerman. Contemporary conditions of the theory of development, pp. 127-143; A.A. Mikhailova and K.V. Chibisov, About various aspects of desensitation, pp. 144-149; G.P. Faerman and Ye. D. Voeikova, Investigations of SOL's used as catalysts for the reductions of silver ions by developers, pp. 150-163; G.P. Faerman, and N.N. Shishkina, Study of Reaction Rates in the reduction of silver ions by developing agents, pp. 164-176; S.G. Bogdanov and P.I. Levina, About the effect of the concentration of the active part of the developing agent in the rate of development, pp. 177-189; I.V. Blyumberg, et al, About the role of diffusion for chemical-photographic processing of films, pp. 190-201; S.G. Bogdanov and N.V. Polyakova, Significant buffer capacities which are manifest in solitions for the development process. II. Factors which determine the improved activity of photographic developers, pp. 202-209; V.I. Sheberstov, Investigation of the relationships of light sensitivity under certain conditions of photographic development, pp. 210-231; V.Ya. Mikhaylov. Several peculiarities of black-and-white aerial films, pp. 232-240. G.G. Bagaeva, Yu. N. Gorokhovskiy and T.M. Levenberg, Investigation into the granualr structure of developed photographic emulsion layers. III. Effect of the composition of the developer and of the sensitometric standards of development upon graininess of photographic reproductions, pp. 241-262; I.B. Blyumberg and T.A. Novatskaya, Several calculated processes for chemical-photographic treatment of motion picture films, pp. 263-269.

The last five articles discuss the treatment of mutlilayer color photographic materials; from the problems of technology of mass treatment of multilayer emulsion color motion picture films, methods of qualitatively controlling these treatments and the problems preserving the color image obtained by color development of multilayer films.

N.I. Kirillov, et al. Rapid processes of NIKFI for the treatment of color multilayer light-sensitive cinema photo materials, pp. 269-280; N.I. Kirillov. Process of separate treatment of color multilayer emulsion of motion picture films in developing machines, pp. 281-294; Yu. N. Gorokhovskiy, About sensitometric control process of chemical-photographic treatment of multilayer emulsion color films, pp. 295-306; L.Y. Kraush and O. Ts. Antononova, Photometric control for the production of color film copies, pp. 307-315; I.I. Levkoyev, et al. The Investigation of preservation of color photographic images from dye-stuff of color development. p. 316.

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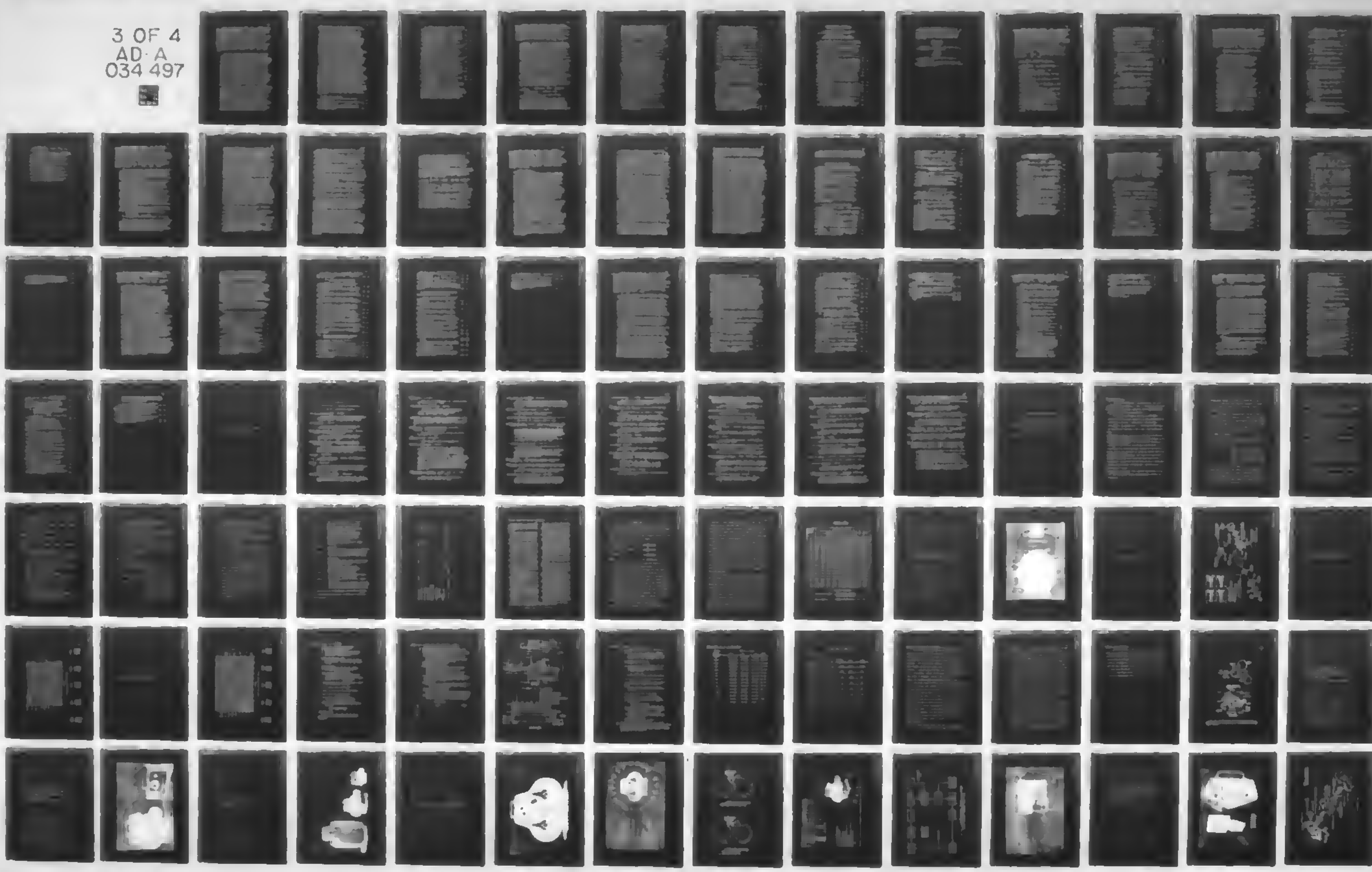

_______. Uspekhi nauchnoy fotografii. Tom V. Voprosy teorii fotograficheskogo protsessa na tsvetofotograficheskikh i cherno-belyikh materialakh. ("Progress in Scientific Photography"). Vol. 5. ("Problems of the Theory of the Photographic Process on Color and Black-and-White Photographic Materials"). Editorial Board: K.V. Chibisov Correspongding Member of the Academy of Sciences of the U.S.S.R. (Chief Editor), Candidate of Chemical Sciences V.I. Sheberstov (Assistant Chief Editor), Professor Ye. M. Goldovskiy, Professor Yu. N. Gorokhovskiv, Professor P.V. Kozlov, Candidate of Technical Sciences V. YA. Mikhaylov, Professor P. G. Tager and Professor G. P. Faerman. Moscow: Izd-vo, "Akademii nauk SSSR" ("Academy of Sciences of the U.S.S.R."), 1957. 205pp. illus.

This fifth volume of Progress in Scientific Photography is published under conditions different than for previous issues as at the present time in addition to Progress. . . . the publication of a new journal--Zhurnal nauchnoi i prikladnoy fotografii i kinematografii (Journal of Scientific and Applied Photography and Cinematography) has begun. In conjunction with this, Progress in Scientific Photography has undertaken new aims--different than in previous issues--in its publishing activities. Henceforth the future mission of Progress in Scientific Photography will be to publish works of reviews and of a general character--that is not about works giving information about some isolated discovery, or about some isolated new results in the area of photography. But works will be given on the resources providing for a full opportunity to study the contemporary stand on various problems discussed in the articles. The articles, presented in this the fifth volume is published with this in mind and has been devoted to several central problems on the theory of the photographic process related to the common "Black-and-White and Color" photographic materials.

The first articles sets forth the results of many years of research on the nature of photographic sensitivity--the problems regarding a number of fundamental as well as permanent actual problems on the subject of theoretical and applied photography. The second article by K.S. Lyalikov sums up the results of research in the area of the theory of physical ripening of photographic emulsions, that is, in the area of the precise stage of manufacture of the emulsions in defining the granularity and photographic composition of the emulsion. Article no. 3 gives a review of the problems associated with the fine structure of the absorption spectra of colored alkalai-halide crystals. These problems are considered of great significance for the theory of the photographic process; as well as for the study of the photochemical process in alkalai-halide crystals closely associated with one of the most

important problems of scientific photography is the study of the primary nature of the photographic process and the nature of the latent image.

The next five articles by G.P. Faerman and his co-workers are devoted to one theme and unified form one objective. In these articles are set forth the results of research on the interaction with silver ions and with silver bromide several organic formations showing stable activity on photographic light sensitive emulsion layers. Several conclusions have been arrived at on the basis of this research about the mechanical activity of photographic stabilizers. The next two articles are devoted to the methodological problems estimating the composition of multilayer color photographic materials and obtaining a color image on them. The first of these by Yu. K. Vifanskiy, Yu. N. Gorokhovskiy, and I.N. Konyushkova is the sixt report in a series on research of the study in the sensitometry of multilayer color photographic materials (other articles in this series were previously published in Progress in Scientific Photography. In the second article--the authors discuss the problems about color difference thresholds expressed in dye concentrations for images in color positive film.

A critical survey is given in the article by K.I. Markhilevich and V.I. Sheberstov of the most important criterion for color sensitivitiy proposed at various times, in particular, here is a critical review of the criterion of domestic system [Soviet system] of sensitometry GOST-2817-50 (State Standard) and several consideraions are discussed about the selection of the optimum criteria. A review of the actions of emulsion-coating wetting agents in the emulsion base system is given in the article by S.M. Levi and O.K. Smirnov. A.S. Polanskiy writes about the life and activities of A.F. Shorin--one of the inventors of the Soviet system of optical sound recording. This collection concludes with an article devoted to the memory of an eminent scientist, a corresponding member of the Academy of Sciences of the U.S.S.R., a Vice-Chairman of the Commission for Scientific Photography and Cinematography of the Academy of Sciences, U.S.S.R., Torichan Pavlovich Kravets, who passed away on the 21st of May, 1955, during the 80th year of his life.

Contents:

Torichan Pavlovich Kravets -- 1876 - 1955

From 1926--head of the photographic laboratory of the State Optical Institute GOI--where he build up a strong research school.

1928--put forward theory of the latent image elaborated on by his students--based on the formation of particles of silver within the silver halide lattice, analogous to the formation of mettalic sodium in sodium halides under the action of light. Kravets was interested in many aspects of photographic theory on which he wrote many articles during his lifetime.

_____. Uspekhi nauchnoi fotografii. Tom. VI. Trudy soveshaniya po vysokoskorostnoy fotografii i kinematografii. (Leningrad, 12 - 15 noyabrya 1957g).["Progress in Scientific Photography. Volume VI. Proceedings of a Conference on High-Speed Photography and Cinematography (Leningrad, November 12 - 15, 1957)"]. Edited by Candidate of Physics-Mathematical Sciences M.P. Vanyukov and Candidate of Technical Sciences I. A. Chernyi. Moscow-Leningrad: Izd-vo, "Akademii nauk sssr ('Academy of Sciences of the U.S.S.R."), 1959. 223pp. illus.

Foreword: The present volume of Progress in Scientific Photography is devoted to problems of high-speed photography and cinematography conducted in the U.S.S.R. This conference was conducted in Leningrad from November 12 - 15, 1957 by the Commission for Scientific Photography and Cinematography of the Academy of Sciences, U.S.S.R., and the State Optical Institute in the name of S.I. Vavilov and pursued as its task the object of uniting the various Soviet scientists and engineering-technical workers, specially devoted to the questions of high-speed photography and the most diverse areas of science and technology.

The presentation of reports at the conference were devoted to a variety of problems,most of which were on high-speed photography techniques and technology, sources of light for the above and at the last its numerous applications. In the current volume have also been published the [full] texts of a majority of reports, in addition to authors abstracts of such reports for which the full texts were not presented or available at this time.

Of considerable importance at the conference was the service of special organizations which conducted a supplemental exhibition of illumination equipment, photography and test apparatus for high-speed photography.

It should be noted that the information given at this conference was simultaneously presented at the 10th All-Union Conference on Scientific Photography (the first conference of such a type was conducted in November, 1932).

Contents:

High-speed cameras with framing frequencies as high as 100,000 per second may be used to photograph events lasting for 0.08 to 10 seconds. Continuous light sources of high power are needed to cover this range of exposures. Satisfactory equipment for a light source of this type are considered to be consisting of: high brightness and small dimensions of the light producing body; high working stability

for even illumination, suitable spectral composition of the light, high light output, long working life and possibility for being overrun for short period of time without damage to the unit. High-intensity carbon arc, high pressure mercury-vapor lamps, high pressure xenon lamps and incandescent lamps for projectors and spotlights are all considered from the above points of view. A table is included showing how each type of lamp meets the requirements.

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K.E. Medvedev. High-voltage ceramic condensers for electronic flash. 75

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The SKS-1 camera, widely used in the Soviet Union is a high-speed motion picture camera taking 150 - 4,000 pictures per second on 16-mm film. Modifications have been made in order to increase the taking speed. The voltage across the motor is increased during running by means of a mechanically operated autotransformer and the four sided reflecting block [prism] is replaced by one with eight sides.

The principles of image dissection in high-speed photography by means of a line or a point grid are outlined. The advantages of a point grid are discussed. Since 1954, a study has been made of the possibilities of using a point grid, consisting of a glass plate with an array of embossed spherical lenses, together with a system of rotating mirrors and a moving film. The necessary characteristics of such a camera required to give the maximum information content are analyzed in relation to the resolving power of the optical system and photographic material.

SVETOCHUVSTVITEL'NYE MATERIALY
("LIGHT SENSITIVE MATERIALS")

PRIMENIYA VYSOKOSKOROSTNOY S'YEMKI
("APPLICATIONS OF HIGH-SPEED PHOTOGRAPHY")

The potentialities of high-speed films in Soviet higher school teaching are briefly reviewed, mention is made of a number of Soviet films which have been made and of the groups which are carrying out this type of work.

TERMINOLOGIYA

("Termonology")

KHRONIKA

("Chronicle")

Abstract of report given on the Third International Congress on High-Speed Photography held in London, England, from September 10-15, 1956.

_______. Uspekhi nauchnoy fotografii. Tom 7. Priroda fotograficheskoy chuvstvitel'nosti. Izogotovleniye galidoserebryanyikh fotograficheskikh sloyev. Opticheskaya sensibilizatsiya i gipersensibilizatsiya. Khimiko-fotograficheskaya obrabotka svetochuvstvitel'nykh sloyev. ("Progress in Scientific Photography"). Volume VII. ("The Nature of Photographic Sensitivity. Manufacturing Silver-Halide Photographic Layers. Optical Sensitization and Hypersensitization. Chemical-Photographic Processing of Light Sensitive Layers"). Editorial Board: Corresponding Member of the Academy of Sciences of the U.S.S.R., K.V. Chibisov, Chief Editor. Candidate of Chemical Sciences, Dotsent V.I. Sheberstov, Assistant Chief Editor. Doctor of Chemical Sciences, Professor Yu. N. Gorokhovskiy. Doctor of Technical Sciences, Professor G.A. Istomin. Candidate of Chemical Science, I.I. Levkoyev. Moscow: Izd-vo, "Academy of Sciences of the U.S.S.R.," 1960. 260pp.

I. Nature of Photographic Sensitivity
Manufacturing Silver-Halide Photographic Layers

_______. Uspekhi nauchnoy fotografii. Tom 8. Tsvetnaya fotografiya i kinematografiya; Fotograficheskaya sensitometriya. ("Progress in Scientific Photography"). Volume VIII. ("Color Photography and Cinematography; Photographic Sensitometry"). Editorial Board: Corresponding Member of the Academy of Sciences of the U.S.S.R., K.V. Chibisov. Professor Yu. N. Gorokhovskiy (Chief Editor). Professor Ye. M. Goldovskiy. Professor K.S. Lyalikov. Piofessor G.P. Faerman. Candidate of Chemical Sciences I.I. Levkoyev. Candidate of Chemical Sciences, V.I. Sheberstov. Moscow-Leningrad: Izd-vo, Academy of Sciences of the U.S.S.R., 1962. 300pp.

______. Uspekhi nauchnoy fotografii. Tom. IX. Vysoko-skorostnaya fotografiya i kinematografiya. ("Progress in Scientific Photography"). Volume IX. ("High-Speed Photography and Cinematography"). Editorial Board: Candidate of Physico-Mathematical Sciences, N.P. Vanyukov. Doctor of Technical Sciences. Professor Ye. M. Goldovskiy. Doctor of Chemical Sciences. Professor Yu. N. Gorokhovskiy. Candidate of Technical Sciences, Dotsent O.F. Grebennikov (Assistant Chief Editor). Professor S.M. Provornov, (Chief Editor). A. A. Sakharov. Candidate of Technical Sciences. I.N. Chernyi, and Corresponding Member of the Academy of Sciences of the U.S.S.R., K.V. Chibisov. Moscow-Leningrad: Izd-vo, "Nauka," 1964. 296pp.

This volume of Progress in Scientific Photography is devoted to the most important problems related to the development of High-Speed Photography and Cinematography and applications in various areas of science and technology accomplished during the period from 1957 to 1962 in the U.S.S.R., and based on the materials presented at the 2nd and 3rd Conference on High-Speed Photography and Cinematography.

The Second Conference was organized by the Commission for Scientific Photography and Cinematography of the Academy of Sciences of the U.S.S.R., together with the Moscow State University in the name of M.V. Lomonosov and the All-Union Scientific-Research Cinema-Photo Institute [NIKFI] and took place in Moscow from May 23 to 26, 1960.

The Third Conference was also organized by the Commission for Scientific Photography and Cinematography, but this time with the cooperation of the Leningrad Institute of Cinema Engineers [LIKI] and the State Optical Institute in the name of S.I. Vavilov and took place in Leningrad from July 4 to 7, 1962.

Reports were presented at each Conference devoted to the development of new equipment, light sources and light sensitive materials for high-speed photography and cinematography, in addition to the numerous applications of high-speed photography in scientific research.

In keeping with the program of the All-Union Conference of High-Speed Photography and Cinematography--this collection has been divided into three separate sections:

1. Devices and Apparatus for High-Speed Photography (18 Articles).
2. Sources of Light. (16 Articles).
3. Applications of High-Speed Photography. (32 Articles).

Section One contains materials on the theory and calculations of high-speed apparatus such as S.M. Provornov, and O.F. Grebennikov's article "About the Fundamental Characteristics of High-Speed Motion Picture Cameras," and the article "The Problems related to Calculations of a Camera with Mirror Scanning." I.I. Kryizhanovskiy has written about the work of the Leningrad Institute of Precision Mechanics and Optics and the new

photographic apparatus developed here; "Slave-Sweep" [Waiting] Apparatus SSKS-3 for shooting 16-mm motion picture film with a frequency up to 300,000 frames per second, and the SSKS-4 camera for shooting on 35-mm film with a framing rate up to 100,000 pictures per second; An accurately synchronized 16-mm camera--Model VSKS-5 for filming at a framing rate up to 3 million frames per second, with a frame format of 7.5 x 10.5mm^2, up to 6 million frames per second with a frame format of 3.6 x 10.5mm^2. The activities of L.V. Akimakina, M.D. Bodrova, S.P. Ivanov and D.F. Ivchenko are presented in the article which is a comparative research program related to the domestic [Soviet] Raster [Grid] Camera Model RKS-1, developed by the Leningrad Institute of Cinema Engineers and the 600 Camera Series developed by the English Firm "Tompson." A new model camera developed by the Leningrad Institute of Cinema Engineers is described in the article "Raster Apparatus (High-Speed Camera) RKS-2 for Shooting at a Frame Rate up to 500 million frames per second by S.M. Provornov, O.F. Grebennikov and V.P. Gusyev. (pp. 27-28).

More than a third of the material presented in the First Section is devoted to apparatus and installation with the utilization of an electro-optical transformer for framing photography and photography with scanning representation. A number of essays are included on the control of electro-optical imaging for research of high-speed processes and on the problems for the informational release of materials with electro-optical imaging systems. The remaining essays discuss methods of high-speed stereoscopic examination with the camera SKS-1 and equipment for stereoscopic examination of slow-motion pictures of high-speed processes by L.V. Akimakina, S.P. Ivanov, D.F. Ivchenko and P.K. Skorabogatov; High-speed photo recorders with filament optics and an electro-optical converter by N.A. Valyus, G.S. Arushanov, and V.P. Generalova, and an essay on the original mechanism for spontaneous observation of high-speed processes (pp54-57) by V.K. Baranov.

The Second Section is primarily devoted to "Sources of Light" and includes the following articles:

I.S. Marshak, L.I. Shchukin. New Data on the Physical and Operational Variables of Electronic Flashlamps, pp. 93-105.

L.N. Bykhovskaya, I. Sh. Libin, and F.A. Charnaya. Nitrogen Electronic Flash Lamps. pp. 106-108.

V.P. Kirsonov, V.P. Zhil'tsov, I.S. Marshak, V.F. Razumtsev, E. Kh. Slutskin, and L.I. Shchukin. New Impulse [Electronic] Lamps with a High Frequency of Flash Repetition. pp. 109-114.

M.P. Vanyukov and A.A. Mak. Research of Flash Sources of Light with a Maximum High Brightness. p. 115.

M.P. Vanyukov, V.I. Isaenko, and V.V. Lyubimov. A Study of the Spatial Instability of the Luminous Bodies of High-Pressure Electronic Flash Lamps, Operating Under Conditions of Repeated Flash. pp. 116-120.

M.P. Vanyukov, V.I. Isaenko, and G.N. Travleyev. Limiting Loads of Electronic Flashlamps Operating under Conditions of Repeated Flash. pp. 121-125.

A.L. Vasserman, and B.V. Skvortsov. The Elements of Light Power Supply for Flash Lamps. pp. 126-130.

M.P. Vanyukov, N.M. Galaktionova, and A.A. Mak. The Ultraviolet Radiation of Electronic Flashlamps. pp. 131-137.

V.A. Gavanin. The Photometry of Electronic Flashlight Sources. pp. 138-141.

A.A. Vorob'yev, G.A. Vorob'yev and G.A. Mesyats. A Study of Several Properties of a Gas Discharge for Obtaining High-Voltage-Nanosecond Flashes. pp. 142-146.

S.I. Andreyev, M.P. Vanyukov and E.V. Daniel'. Methods of Shortening the Duration of Light Flashes from a Spark Discharge. pp. 147-150.

M.P. Vanyukov, N.M. Galaktionova, V.F. Yegorova and A.A. Mak. The Radiation from a Spark Discharge in Mixed Gases. pp. 151-152.

S.I. Andreyev and M.P. Vanyukov. Obtaining Intense Light Flashes with a Duration of 10^{-7} -- 10^{-8} second with the Aid of a Spark Discharge. pp. 153-158.

I.S. Marshak, V.I. Vasil'yev, A.L. Vasserman, and I.L. Tokhadze. High-Power Tubular Xenon Lamps Without Ballast--A New Type of Effective Light Source for High-Speed Cinematography. pp. 159-166.

V.A. Gorshkov, I.V. Podmoshenskiy and L.V. Popov. The Use of Heavy Elements in High-Power Capillary Light Sources. pp. 167-170.

A.A. Vorob'yev and V.A. Moskalyev. Source of X-Ray Radiation for High-Speed Photography for Some Processes. pp. 171-172.

Section Three includes 32 articles from 50 authors dedicated to the problems of scientific and applied applications of high-speed photography and cinematography. These articles primarily pertain to cinema research in various areas of contemporary science, industry, and rural society; physics of solid bodies, gas dynamics and hydrodynamics, mechanics and industrial technology, etc.

The experiments graphically illustrate applications of high-speed photography in the practical work of scientific research institute, educational institutes and in the production undertakings of industry, etc. V.G. Pell' has also included his article "On Exposure for High-Speed Photography (p. 173) and about the training of students of higher educational institutes in the applications of photography and cinematography methods in science and technology [engineering]. (p. 291).

Since the overall collection was limited in size, many reports, especially on applications of high-speed photography have been presented in abridged form. In any event, a detailed summary of the applications of high-speed photography pertinant to theoretical and experimental conclusions have been included for research of further problems for the methods of high-speed photography.

In spite of the considerable period of time that has elapsed since the Second and Third Conferences on High-Speed Photography and Cinematography were conducted, the material published in this issue has not lost its scientific and practical value and this volume should be recommended to the attention of a wide circle of specialists--who are interested in the perfection and practical applications of the method of high-speed photography.

Though a majority of the reports presented at the conferences were included in this volume, several reports that were previously published in the Zhurnal nauchnoy i prikladnoy fotografii i kinematografii ("Journal of Scientific and Applied Photography and Cinematography") have not been included. Reports not published in this volume include:

1. G.I. Belinskaya. The Quality of the Image in High-Speed Slow-Motion--Motion Picture Cameras. JSAPC, Vol. VI (1961) pp. 213-219.
2. G.L. Shnirman, A.S. Dubovik, P.V. Kevlishvili, A.V. Granigg, and L.A. Korolev. High-Speed Slave-Sweep [Waiting] Photorecorder ZhLV-1. JSAPC, Vol. VIII (1963), pp. 50-56.
3. A.S. Dubovik, N.M. Sitsinskaya, G.V. Kolesov. High-Speed Raster (Grid) Microphotographic Apparatus SFR-R. JSAPC. Vol. VIII (1963). 128-134.
4. A.S. Dubovik, and A.B. Granigg. About the Determination of the Position of the Scanning Center and Nonuniformity of the Taking Frequency in High-Speed Cameras with Image Compensation. JSAPC, Vol. VIII (1963). pp. 276-283.
5. V.V. Garnov, V.V. Shauro. High-Speed Photography of Self-Luminous Processes on Color Film. JSAPC, Vol. VIII (1963).
6. M.N. Negodayev, A.I. Borisov, and V.A. Tat'kov. Visualization of the Hydrodynamic Process in a Coal Pump by High-Speed Cinematography. JSAPC, Vol. XI, (1964), pp. 168-171.

________. Uspekhi nauchnoy fotografii. Tom X. Kachestvo fotograficheskogo izobrazheniya. ("Progress in Scientific Photography"). Volume X. ("Quality of the Photographic Image"). Editorial Board: Corresponding Member of the Academy of Sciences of the U.S.S.R. K.V. Chibisov, Professor Yu. N. Gorokhovskiy (Chief Editor), Candidate of Physico-Mathematical Sciences A.T. Ashcheulov [Deceased], Professor G.A. Istomin, Professor G.P. Faerman, Candidate of Technical Sciences I.I. Cherniyi and Candidate of Chemical Sciences V.I. Sheberstov. Moscow-Leningrad: "Nauka," 1964. 268pp.

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From the Editors--Foreword.

The present volume of Progress in Scientific Photography is devoted to the problem of the quality of the photographic image from the standpoint of the volume of information it relays as well as the sharpness and graininess of the image. This problem is one of the most important ones facing modern photographic science as well as still and motion picture photographic techniques. Much attention is being devoted to it in both the Soviet Union and abroad. It is closely related to the problems of optical, visual and television images, and must be solved at the present time by the use of mathematical methods of the theory of optical instruments and the theory of the technique of television. On the other hand, it is also closely tied with the questions of energetics of the photographic process: Any improvement of the quality of the photographic image in any of the above respects is an indication of an increase in the energy effectiveness, i.e. (light-sensitivity) of the photographic system.

The time has arrived to bring together the results achieved by Soviet scientists in this field during recent years. To help, in some measure, to achieve this goal, is the purpose of the present volume on [Progress in Scientific Photography]. Basically, this volume consists of reports presented at the XIII Conference on Scientific Photography, devoted to the "Quality of the Photographic Image" held in Moscow from January 29 to February 1, 1962. In addition, this present volume also includes several scientific papers (identified with an asteristk in the text) which were received later and had not been reported upon at the Moscow meeting. Two of these papers were presented at a symposium on the structural properties of photographic materials and the capabilities of the latter to relay information, which was held at Kazan' on September 30, 1963.

A collection of original papers and a few reviews--such as included in this volume--cannot, of course, take the place of books in which the problem of interest to us could be examined systematically, in all of its multifaceted complexity. The duty of our scientists--is to produce such a book, as it is vitally needed.

K.V. Chibisov. Introductory Remarks Delivered at the XIII Conference on Scientific Photography. p. 5-6.

The development of all branches of science, technology and of the national economy of the Soviet Union must obey the general plan, which was outlined by the XXII Congress of the Communist Party of the Soviet Union. The new Program of the CPSU adopted at that Congress brings together all the great wealth of experience of socialist construction in the U.S.S.R., and represents a creative development of the revolutionary science of Marx--Engels--and Lenin. It stresses, with particular emphasis, the importance of science in the progress of all branches of the national economy and the upsurge of culture in our country. Before Soviet Science are posed two basic problems: the development of theoretical investigations and the union of science and production.

The XXII Congress of the Communist Party of the Soviet Union indicated to Soviet scientists that it was indispensable to first of all strengthen the leading position already captured by Soviet science in some of the most important branches of knowledge and to make certain that, in the future, too, it will play a leading role in all principal areas of world science. This responsible tast can only be solved in ways outlined in the Program of the CPSU, namely: an all-out development of theoretical science in all its aspects and an intimate interdependence between science and production. In other words, the progress of industry and the progress of science are in our time--inseparable. Therefore, the success of theoretical studies which will recieve the broadest development must have a decisive influence upon technical progress.

Photographic science and technology do not belong to the basic, leading sectors of science and technology; nevertheless this area of knowledge has an enormous importance as being, on the one hand, the basis of the illustrative art of photography--and, especially, cinematography, and, on the other hand, as an auxiliary method used in many different spheres of the national economy. At the present time, photographic and motion picture methods of investigation and control are being used--to a greater or lesser extent--in practically every single brance of science and technology. Therefore, there can be no doubt but that scientific and technical progress in the field of photography and cinematography must fully meet the requirements posed by the Program of the Communist Party of the Soviet Union with respect to various branches of science, technology, the national economy and culture.

The present conference is devoted to a large number of very important questions dealing with the Quality of the Photographic Image. This is the first time that these questions are being treated in this country on such a broad scale, although the principle of the complex problem of image quality is not new. In photography and cinematography, the quest of image quality was always present, but it was generally evaluated in terms of

good or bad, sharp or unsharp, high contrast or low contrast; in other words, the evaluation had an essentially descriptive character. At the present time such a quality evaluation is becoming unsatisfactory not only in the fields of photography and cinematography, but also in other areas of the national economy.

The growing utilization of small-format photography, narrow-film cinematography, and the application of photography for various purposes of documentation and scientific recording, as well as the significant decline in image quality with the use of extra-sensitive photo materials, render more and more pressing the problem of quantitative evaluation of photographic information and the development of ways to increase the volume of such information. At the same time, such quantitative methods as photo sensitometry, measurements of resolution and detail, as well as the theory of tonal reproduction, could not fully solve this problem. For this reason, more and more attention was being devoted--especially in the postwar years--to the development of methods of objective evaluation of the quality of the photo image and the development of suitable criteria for determining the informational capability of photo materials in both still and motion picture photography. This line of research was also of great interest for the development of means to eliminate flaws in emulsion layers as well as improving their processing. Of late, methods of the theory of information are being used more and more in the field of both photography and cinematography.

It might be added to the foregoing that, besides photography and cinematography, there exists also other technical systems--optical, electronic-optical, and television--which transmit and retain information. Despite all their variety and differences, the one thing they have in common is the fact that the source of the information, in all cases, is an image. It would therefore appear to be both natural and useful to bring together the results of research into image quality of the various systems as well as the improvements in the methods of objective evaluation of their information capacity. Of great importance, too, would seem to be an extension of the methods of the theory of information to the visual analyzer as well.

The program of the conference was very extensive. On the basis of the number of reports presented, first place goes to the State Optical Institute in the name of S.I. Vavilov (13 reports). Next comes the All-Union Scientific-Research Cinema-Photographic Institute (with 6 reports), and the remaining reports represents eight other scientific institutions. Thus Soviet scientists are now devoting serious attention to the complex and, from a practical standpoint, exceptionally important problem of image quality produced by various systems--even though the study of these questions in this country was started with considerable delay. In this connection it is fitting to remark that several such conferences have already been held abroad, and that methods of objective evaluation have already begun to applied in industry.

In conclusion, we wish to stress our conviction that an exchange of experience and discussion of individual problems is bound to be useful and will serve as a further stimulus for the development of scientific research work in this field.

I. Quality of the Optical Image

II. Quality of the Photographic Image

III. Television Image and its Connection with a Photographic Image

IV. Other Forms of Images

V. Grain Structure of Photographic Images

VI. Photographic Materials and their Chemico-Photographic Processing from the Image Quality Viewpoint

_____. Uspekhi nauchnoy fotografii. Tom XI. Khimiya fotograficheskikh emul'siy. Strukturnye svoystva fotograficheskikh sloev. ("Progress in Scientific Photography"). Volume XI. ("Chemistry of Photographic Emulsions. Structural Properties of Photographic Layers") Editorial Board: Corresponding Member of the Academy of Sciences of the U.S.S.R., K.V. Chibisov. Candidate of Chemical Sciences, S.A. Bongard, Candidate of Technical Sciences A.V. Borin, Doctor of Chemical Sciences, Professor Yu. N. Gorokhovskiy, Doctor of Technical Sciences, Professor G.A. Istomin. Doctor of Chemical Sciences, Professor K.S. Lyalikov. Engineer, V.N. Sintsov, Doctor of Chemical Sciences, Professor G.P. Faerman. Doctor of Technical Sciences, V.I. Sheberstov (Chief Editor). Moscow-Leningrad: Izd-vo, "Nauka," 1966. 231pp.

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The articles presented in this volume are for the most part reports given at the 15th Conference on Scientific Photography held simultaneously with the 2nd Conference on the Chemistry of Photographic Emulsions, conducted in Kazan from 25-28 September, 1963.

_______. Uspekhi nauchnoy fotografii. Tom XII. Yadernaya fotografiya. ("Progress in Scientific Photography"). Volume XII. ("Nuclear Photography"). Editorial Board: Doctor of Physico-Mathematical Sciences, K.S. Bogomolov, Candidate of Technical Sciences, Ya. M. Veprik, Doctor of Chemical Sciences, Yu. N. Gorokhovskiy, Candidate of Physico-Mathematical Sciences, A.L. Kartuzhankiy (Chief Editor), Doctor of Chemical Sciences, K.L. Lyalikov, Doctor of Physico-Mathematical Sciences N.A. Perfilov, Corresponding Member of the Academy of Sciences of the U.S.S.R., K.V. Chibisov. Moscow-Leningrad: Izd-vo, "Nauka," 1966. 163pp.

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II. Treatment of Nuclear Photo Emulsions

III. Measuring and Analysis of Tracks in Nuclear Photo Emulsions

_____. Uspekhi nauchnoy fotografii. Tom XIII. Khimiko-fotograficheskaya obrabotka fotokinomaterialov. ["Progress in Scientific Photography"]. Volume XIII. ["Chemical-Photographic Treatment of Motion Picture Photographic Materials"]. Editorial Board: Yu. N. Gorokhovskiy [Chief Editor], et al. Leningrad: Izd-vo, "Nauka," Leningrad Section, 1968. 314pp.

Contents: From the Editor. 3
Dedicated to Konstantin Vladimirovich Chibisov, Honoured Scientist and Technician of the RSFSR., and Corresponding Member of the Academy of Sciences of the U.S.S.R.

This volume of Progress in Scientific Photography is devoted to the problems of the Chemical-Photographic Treatment of Light Sensitive Materials. As in a majority of preceding issues, this volume is devoted to proceedings of the regular conference (17th) on Scientific Photography which was convened by the Commission for the Chemistry of Photographic Processes of the Academy of Sciences of the U.S.S.R. This Conference took place in Moscow from June1-4, 1965 and is the second one specifically devoted to Chemical Photographic Processing: the first conference took place in 1954 and the Proceedings were published during 1955 in Volume IV of Progress in Scientific Photography. All reports presented at the Conference have been published in this collection of important information.

This volume has been dedicated to the outstanding scientist in the area of Scientific Photography, K.V. Chibisov a Corresponding Member of the Academy of Sciences, of the U.S.S.R., who celebrated his 70th birthday on March 1, 1967. Chibisov began his research work in 1919 and for 50 years has devoted his creative life and talents to working on a series of problems related to the photographic process and photographic technology. He not only popularized scientific photography but was instrumental in the training of specialists for this field of endeavour at Moscow University and elsewhere. Among the more important problems tackled by Chibisov were photographic sensitometry, and aerial photography, chemistry of photographic emulsions and chemical photographic treatment of light sensitive materials in addition to the nature of the photographic sensitivity of silver halide.

Chibisov created special developers for aerial films and as an author published in 1930 material on microcinematography research of the process of development, which was quite unique for its time. Chibisov played an important role in the organization of the All-Union Scientific Cinema-Photo Research Institute [NIKFI] and served as the director of the Chemical Department for many years. He has been the author of numerous reviews on the fundamental nature of the photographic process and theory of sensitometry and published the book The Theory of Photographic Processes, Vol. 1 (1936).

K.V. Chibisov is a universally recognized author on chemical photographic emulsions and the nature of light sensitivity (his opinions and results of numerous research and general conclusions are included in the monograph Osnovnye problemy khimi fotograficheskikh emulisiy. 1962. ("Fundamental Problems of the Chemistry of Photographic Emulsions," 1962).

K.V. Chibisov together with T.P. Kravetz founded a permanent Chair on the Commission for Scientific Photography and Cinematography (at the present time called the Commission on the Chemistry of Photographic Processes) of the Academy of Sciences, of the U.S.S.R. Chibisov was solely responsible in the U.S.S.R. for organizing the Department on Scientific and Engineering Photography and Cinematography at MGU (Moscow State University in the name of M.V. Lomonosov) created in 1956. In addition, Chibisov was a permanent Chief Editor of Zhurnal nauchnoy i prikladnoy fotografii i kinematografii ("Journal of Scientific and Applied Photography and Cinematography"), also created in 1956.

This list of activities of the work accomplished by K.V. Chibisov as a scientist, organizer, pedagogue and public spirited statesman is far from complete. His great energy, his wide views and benevalence to society is well known to all.

I. Mechanism and Kinetics of Photographic Development

______. Uspekhi nauchnoy fotografii. Tom XIV. Stareniye i stabilizatsiya fotograficheskikh materialov. ("Progress in Scientific Photography"). Volume XIV. ("Aging and Stabilization of Photographic Materials"). Editorial Board: Candidate of Technical Sciences A.V.Borin, Doctor of Chemical Sciences--Professor Yu. N. Gorokhovskiy, Doctor of Physics-Mathematical Sciences A.L. Kartuzhanskiy (Chief Editor), Candidate of Chemical Sciences, G.P. Krupnov. Corresponding Member of the Academy of Sciences of the U.S.S.R. K.V. Chibisov. Doctor of Technical Sciences, V.I. Sheberstov. Leningrad: Izd-vo, "Nauka," Leningrad Section, 1970. 227pp.

This volume is devoted to two inderdependent problems of photographic science and practices--the aging and stabilization of photographic materials.

The aging of emulsion layers of photographic materials--that is, changing their characteristics (more often degrades the overall sensitivity and increases fog) during the time between its manufacture and its utilization. For the present time this still remains the primary reason by which photographic materials can become worthless. To all appearances the complete removal of aging that occurs is possible but for the most part not always practicable, suffice it to say, to achieve even a significant retardation offers a great practical interest in promoting solutions to the most important technical and economical tasks.

Here is why the problems of aging prove to be closely related to the problems of stabilization--the second problem presented in this volume. Stabilization is understood to be the inhibition of aging by means of introducing a number of substances--called stabilizers, mainly several classes of organic combinations.

Stabilizers are introduced not only at various stages during the manufacture of photographic emulsions, but also in the preparation of emulsion layers; the moment prepared for the introduction may very well influence the stages of development--that specifically--is what an entire section of this volume has been devoted to.

The interest to the problems of aging and stabilization depends on several things, but should be of significance not only to those working in industry but to those who are also engaged in the theory of the photographic process

Aging is considered a direct result of the evolution of impurity centers created in microcrystals of the photographic emulsion prior to its development and determines its fundamental photographic characteristics--senstivity and fog. Therefore research on the regulating and mechanism of aging,in the end, accounts for obtaining additional information about the inherent nature and characteristics of important properties of photographic emulsions; Aging plays a significant role, as shown by various experiments, as an evolutionary process in which the

growth of impurity centers continue even during the time of emulsion manufacture.

No less significant for clearing up the mechanism of various phenomenom in such a complex physico-chemical system of the photographic emulsion, is the study of its interaction with organic stabilization. All of this fully explains why the need to study the processs of aging and stabilization. In recent times the synthesis and tests of new stabilizers have been engaged in by many of the scientific research establishments of our [Soviet] country, in Moscow, Leningrad, Kiev, Kazan, etc.

As previously mentioned, these problems were specifically discussed at the 19th Conference on Scientific Photography which took place in Kazan from September 27 - 30, 1967. This volume is devoted to the texts of the reports presented at the Kazan Conference--the Meetings together with the publication of these reports give numerous readers who were not able to participate in the conference the opportunity to obtain ideas on the present state of the problems of aging and stabilization and long term perspectives; About what there is available in this area of progress and about the fundamental problems and forthcoming decisions which have the largest scientific interest and practical value.

Together with the reports of the Kazan Conference have been included in this volume several analogous works, which were not presented at the conference for one reason or another, these works have been marked with a asterisk in the table of contents.

Contents:

_______. Uspekhi nauchnoy fotografii. Tom XV. Osnovnye problemy fotograficheskoy nauki. ("Progress in Scientific Photography"). Volume XV. ("Fundamental Problems of Photographic Science"). Leningrad: Izd-vo, "Nauka," Leningrad Section, 1970. 310pp. illus.

Contents: From the Editor. p. 3.

______. Uspekhi nauchnoy fotografii. Tom XVI. Vyisokomolekulyarniye soedineniya v fotograficheskikh protsessakh. ("Progress in Scientific Photography"). Volume XVI. ("High-Molecular Compounds in Photographic Processes"). Leningrad: Izd-vo, "Nauka," Leningrad Section, 1972. 227pp.

Editorial Board: Corresponding Member of the Academy of Sciences of the U.S.S.R., K.V. Chibisov; Doctor of Chemical Sciences Yu. N. Gorokhovskiy; Doctor of Chemical Sciences P.V. Kozlov; Doctor of Chemical Sciences K.S. Lyalikov; Candidate of Technical Sciences V.N. Sinstov; Doctor of Chemical Sciences G.P. Faerman (Chief Editor); Doctor of Technical Sciences V.I. Sheberstov.

High-Molecular Compounds have been utilized for a long time in the technology of manufacturing photographic materials in the capacity of materials for manufacturing flexible film base materials (film supports) for photography and motion picture photography. During the past years the traditional uses of high-molecular compounds for photography has attained substantial success. At the present time the applications of high-molecular compounds has conquered many new areas in photography and in the capacity of light sensitive materials for new types of photographic materials.

The task of the 18th Conference on Scientific Photography which took place from October 21-25, 1966 in Moscow (the materials of which have been included in this volume) was to shed light on modern day advances in the U.S.S.R. in the research for the utilization of high-molecular compounds in chemical photographic processes, in the technology for the manufacture of photographic materials and to also contemplate perspectives [Longe-Range Plans] for the further research in this area.

Volume XVI of Progress in Scientific Photography includes articles giving an account of the reports presented at the 18th Conference.

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IV. High-Molecular Compounds for Chemical and Optical [Spectral] Sensitization and for Coating Hardening Phase of Photographic Emulsions.

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SELECTED LIST OF JOURNALS AND PERIODICALS FOR USE AS REFERENCE MATERIALS

CHAPTER XII

SELECTED LIST OF JOURNALS AND PERIODICALS

FOR USE AS REFERENCE MATERIALS

American Cinematographer. Monthly.

International Journal of Motion Picture Photography and Production Techniques. Published by ASC Holding Corp., 1782 North Orange Dr., Hollywood, California, 90025.

Applied Optics. Monthly.

Published by the Optical Society of America, Inc., 2100 Pennsylvania Ave., Washington, D.C., 20037.

British Kinematography, Sound and Television. Monthly. [Formerly British Kinematography].

Journal of the British Kinematography, Sound and Television Society. 110-112 Victoria House, Vernon Place, London W.C.I., England.

Bulletin of the Society of Photographic Science and Technology of Japan. Annually. [in English].

Society of Photographic Science and Technology of Japan. [Formerly: Society of Scientific Photography in Japan, Bulletin]. Nippon Shashin Gakkai, 2-9-5, Hon-cho, Nakano-Ku (Tokyo College of Photography), Tokyo, Japan.

Close-up. Quarterly.

Polaroid Corporation. "Close-up," 549 Technology Square, Cambridge, Mass., 02139.

Corona. Quarterly

A journal to deal more strictly with the Kirlian Effect. Check for Availability with The Boulder Institute of Electro-Photography. 885 Araphahoe, Boulder, Colo., 80302.

Color Research and Application. Quarterly.

Began publication No. 1 Spring (March, 1976). The only English Language Journal devoted solely to color. Published by Wiley-Interscience, 605 Third Ave., N.Y., N.Y., 10016.

Electronics. bi-weekly.

McGraw-Hill Book Publishing Co., Inc. 330 West 42nd Str., New York City, New York. 10036.

Electro-Optical Systems Design. monthly.

Encompasses all aspects of electro-optics. Official publication of the Laser Institute of America. Milton J. Kiver Publications, Inc., 222 West Adams, Chicago, Ill., 60606.

Functional Photography: The Magazine of Photographic Applications in Science, Technology and Medicine. [Formerly: Photographic Applications in Science, Technology and Medicine]. Name change as of Sept, 1975, Vol. X, No. 5.

Image Dynamics in Science and Medicine. bi-monthly. [Formerly, Visual/Sonic Medicine].

North American Publishing Co., 134 North 13th Street. Philadelphia, Pa., 19107.

Image Technology. bi-monthly.

Graphic Management Corporation, Washington, D.C.

Industrial Photography. monthly.

United Business Publications, Inc., Subsidiary of Media Horizons Inc., 750 Third Ave, New York, N.Y. 10017. Publishes yearly directory of Photographic Equipment and Services, Vol. XXIV, No. 12 Industrial Photography; 1976 Gold Book (December, 1975) 194pp. Will help user to obtain information through 1976 about equipment, materials, and services through product literature available from leading manufacturers, distributors and service companies. Includes materials on still and motion picture equipment, lenses, instrumentation equipment and special purpose cameras, lighting, darkroom and processing equipment, audio-visual, video production equipment, holography, laser systems, microscopes and accessories, special equipment and services, etc.

Instrumentation Technology. monthly. Vol. XXI -- 1974; Vol. XXII -- 1975; Vol. XXIII - 1976.

Journal of the Instrumentation Society of America. 400 Stanwix Street, Pittsburg, Pa. 15222.

International Photo Technik. quarterly.

Editions in English, German and French for applied medium and large-format photography in industry, science and technology and high standard amateur photography. München: Verlag Grossbild-Technik GMBH. Nikolaus Karpf, Editor-in-Chief, Owner, Publisher.

Journal of Photographic Science. bi-monthly.

Royal Photographic Society of Great Britain, 14 South Audley Street, London, England.

Journal of the Biological Photographic Association. quarterly.

BPA, PO. Box 1057. Rochester, Minnesota. 95901.

Journal of the SMPTE. monthly. [Beginning with January, 1976 issue this journal is retitled as the SMPTE Journal].

Title changes 1916-1976: Transactions of the Society of Motion Picture Engineers; Journal of the Society of Motion Picture Engineers; Journal of the Society of Motion Picture and Television Engineers; Journal of the SMPTE; SMPTE Journal.
Engineering, Science, Technology--for Motion Pictures, Television, Instrumentation, High-Speed Photography.
Society of Motion Picture and Television Engineers, Inc., 862 Scarsdale Ave., Scarsdale, New York. 10583.

JPL Quarterly Technical Review. quarterly.

Jet Propulsion Laboratory. California Institute of Technology, Pasadena, California.
Includes papers on antenna design, computer applications, control and guidance, electronics, photography, rocketry, solar studies, testing methods, abstracts of technical reports, technical memorandums and JPL Quarterly Technical Review Open Literature Reporting.

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Laser Focus: The Magazine of Lasers and Related Technologies. monthly. [With Two issues in February]. Vol. XII, 1976.

Advanced Technology Publications Inc., 385 Elliot Street. Newton, Mass.; Also Laser Focus Buyers Guide (Annual).

Medical and Biological Illustration. quarterly.

The Journal of the Institute of Medicine and Biological Illustration. London: Tavistock Square. British Medical Assn. Since 1951. Vol. XXV, 1975. Available from British Medical Journal, 1172 Commonwealth Ave, Boston, Mass., in the USA.

Optical Engineering. bi-monthly. [Formerly S.P.I.E. Journal].

The Journal of the Society of Photo-Optical Instrumentation Engineers--S.P.I.E. S.P.I.E. National Office, P.O. Box 1146. Palos Verdes Estates, California. 90274.

Optical Spectra. [The Magazine of Optical/Electro-Optical/ Laser Technology]. monthly.

Optical Publishing Co., Inc., Lenox Rd., Pittsfield, Mass. 61201.

Optical Spectra, Vol. IX, No. 12 (December, 1975). David Anafi and Joseph P. Machewirth. "Nonlinear Optics." pp. 25-28; "Fifty Years of Optics," (Staff Report), pp. 29-37; Cumulative Index, Vol. IX, 1975.

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International Journal of Research, Systems and Design in Optics. IPC (America), Inc., 205 East 42nd Street, New York City, N.Y. 10017.

Optics and Spectroscopy. monthly.

Optical Society of America. 2100 Pennsylvania Ave, N.W., Washington, D.C. 20037. [English Language Translation of the Russian Journal Optika i spektroskopiya.

Optics News. quarterly.

Optical Society of America, 2000 L Street N.W. Washington, D.C. 20036.

Perspective: Quarterly Review of Progress. Photography, Cinematography, Sound and Image Recording.Vol. VII, No. 1 (1966) Special Issue. High-Speed Photography and Cinematography. London: Focal Press Ltd., Began Publication in 1959.

George H. Lunn. HSP-7. pp. 5-17.
W. Thorwart. The Sophisticated Sport. pp. 18-37.
J.K. Landre. Accelerating the Camera. pp. 38-58.
Richard Fisch. Managing Information. pp. 51-58.

Photogrammetric Engineering. monthly.

American Society of Photogrammetry. 105 North Virginia Ave. Falls Church, Va., 22046.

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Photographic Applications in Science, Technology and Medicine. 250 Fulton Ave., Hempstead, N.Y. 11550.

Photographic Journal. . monthly.

Royal Photographic Society of Great Britain.

Photographic Science and Engineering. bi-monthly.

Journal of the Society of Photographic Scientists and Engineers. Suite 204. 1330 Massachusetts Ave, Washington, D.C. 20005.

Photomethods. monthly. [Formerly PMI--Photo Methods for Industry].

Gellert Publishing Corp. A Subsidiary of Ziff-Davis Publishing Co., 1 Park Ave. New York, N.Y. 10016.

PSA Journal. monthly.

Photographic Society of America. 4707-F N. Paulina St. Chicago, Illinois. 60640.

Referativnyi zhurnal: Fotokinotekhnika.[Reference Journal: Photo-Cinema Technology]. monthly. since 1963. Moscow: Nauchnoy informatsii ("Scientific Information").

Provides access to Russian and East European literature for those who have a knowledge of the Russian language.

Research Applied in Industry. London: Butterworths Scientific Publications.

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W.D. Chesterman. "High-Speed Photography in Naval Research," Research Applied in Industry, Vol. XI, No. 8 (August, 1958), pp. 301-309.

Review of Scientific Instruments. monthly.

A publication of the American Institute of Physics. 335 East 45th Street. New York City, N.Y. 10017.

Science et industries photographiques. Series 2. monthly. Paris: Revue mensuelle. with collaboration of internationale Publiee sous les auspices, De L'institut D'optique Theorique et Appliquee.

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Journal of the Armed Forces Communications and Electronics Association. Communication, Electronics, Technical Photography. Skyline Center. 5205 Leesburg Pike Falls Church, Va. 22041.

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Sky Publishing Corporation. 49-50-51 Bay State Road. Cambridge, Mass. 02138.

Society of Photographic Scientists and Engineers. SPSE. Journal of Applied Photographic Engineering. Vol. I. (Fall, 1975).

Official publication of the Society of Photographic Scientists and Engineers. 1300 Massachusetts Ave, N.W. Washington, D.C. 20005.

Sovetskoye foto. monthly.

Ministry of Culture, U.S.S.R.; Mezhdunarodnaya kniga Smolenskaya sennaya 32/34. Moscow. G-200, U.S.S.R.

Soviet Journal of Optical Technology. bi-monthly.

American Institute of Physics. 335 East 45th Street. New York City, N.Y. 10017. English Language Translation of the Russian Journal Optiko-mekhanicheskaya promyshlennost. Sponsored by the Optical Society of America.

The Astrograph. bi-monthly. devoted to Astrophotography.

The Astrograph. Box 2283. Arlington, Va. 22202.

Technical Photography. monthly.

The publication for industrial, government, military still and cine photographers. Technical Photography. 250 Fulton Ave, Hempstead, New York.

Tekhnika kino i televideniya. ("Cinema and Television Techniques"), monthly. (in Russian).

Gosudarstvennyi komitet po kinematografii, Moskva, SSSR. ("State Committee for Cinematography, Moscow, U.S.S.R."). Available at the Doheny Library, Special Collections--Cinema, University of Southern California, Los Angeles, California.

Trudy vsesoyuznogo nauchno-issledovatelsky kinofotoinstitute. Otdel nauchno-technicheskoy informatsii NIKFI. ("Journal of the All-Union Scientific-Research Cinema-Photo Institute. Department of Scientific-Technical Information, NIKFI"). Moscow: US.S.S.R. in Russian.

Various issues are available at the Doheny Library, Special Collections--Cinema, University of Southern California, Los Angeles, California. 90007.

Uspekhi nauchnoy fototgrafii. ("Progress in Scientific Photography"). Moscow: Izd-vo, "Nauka," ("Science Press") since 1956--irregular publication. 16 issues to 1972.

Volumes 1-9 available through inter-library loan from the Center for Research Libraries, Chicago, Illinois; Volumes 9-16 are available at the Engineering-Math-Sciences Library, University of California, Los Angeles, California (UCLA).

Zeiss Information. Appears several times a year in English, French, German, Italian, and Spanish. Publisher is Carl Zeiss 7082 Oberkochen, West Germany.

Zeitschrift für wissenschaftliche photographie, photophysik und photochemie. ("Journal of Scientific Photography, Photo Physics, and Photo Chemistry"). Leipzig: Verlag Johann Ambrosius Barth. in German.

Zhurnal nauchnoy i prikladnoy fotografii i kinematografii. ("Journal of Scientific and Applied Photography and Cinematography"). Moscow: Academy of Sciences of the U.S.S.R. since 1956 bi-monthly. (Six issues per year).

Prime publication for Scientific and Applied Photography and Cinematography in the U.S.S.R.

Volumes 1-9 are available through inter-library loan from the Center for Research Libraries, Chicago, Illinois.

Volumes 9-20 are available at the Research Library, University of California, Los Angeles, California (LA).

Volume 20--1975 will be available at the Doheny Library SPECIAL COLLECTIONS--CINEMA, University of Southern California, beginning April, 1976.

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PHOTOGRAPHIC REFERENCE MATERIAL

The application of photographic instrumentation requires the constant use of formulas and pertinent data in the planning and operation of a data gathering system.

The following material has been compiled for this use.

Basic Definitions

The term "Photographic Instrumentation" was first defined by Kenneth Shafton in 1951 as "THE USE OF THE PHOTO MEDIUM FOR THE DETECTION, RECORDING AND OR MEASUREMENT OF SCIENTIFIC AND ENGINEERING PHENOMENA."

In 1963 the High-Speed Committee of the SMPTE established a definitions committee to define such terms as "Photographic Science," "Photographic Engineering," "Photographic Instrumentation," "Photographic Technology," and "Photographic Systems,"--which were finally approved in 1964.

Photographic Science.--Systematized knowledge derived from observation and study of photography and photographic systems.

Photographic Engineering.--The Application of scientific knowledge in the field of photography, photographic instrumentation, and photographic systems to the creation of plans, designs and the means of achieving desired objectives.

Photographic Instrumentation.--The branch of photographic science, engineering and technology concerned with the development, construction and the application of photographic systems, especially for the detection, recording and/or measurement of events.

Photographic Technology.--The practical application of the tools and techniques created by photographic science and engineering.

<u>Photographic System</u>.--The optical, mechanical, light sensitive, electrical, and chemical components, together with the plans for their use for achieving a desired photographic end result.

"Photographic Instrumentation" has been further defined as the "use of photosensitive material and supplies used for the detection and measurement of engineering and scientific phenomena." Actually it is an aid to the human eye, to enable it to overcome its limitations as to time, illumination, distance, area and storage ability.

<u>Instrument Codification</u>

In 1948--classification by exposure time was used as a basis for categorizing the various techniques of high-speed photography.

Normal speed.--defined as photography requiring an exposure longer than 1/100 second. Single frame photography with exposure times shorter than 1/1000 second was classified as high-speed still photography.

The upper picture frequency limit for motion picture photography was set at 250 frames per second based on the upper limit of intermittent camera mechanisms in use at that time. High-Speed Motion Picture Photography was assigned the range of from 250 to 10,000 frames per second. Ultra High-Speed Motion Picture Photography was classified as picture

frequencies exceeding 10,000 frames per second. These time scales were later amended--motion picture photography was classified as 8 - 275 frames per second.

High-Speed Motion Picture Photography was classified into three categories: High-Speed, Very High-Speed and Ultra High-Speed.

High-Speed.--275 to 20,000 frames per second. Picture frequencies less than 275 fps exposed at less than 1/1000 second per frame was considered to be a special case of high-speed motion picture photography.

Very High-Speed.--Frequencies with the range of 20,000 to 500,000 frames per second.

Ultra High-Speed.--Picture frequencies exceeding 500,000 frames per second.

The past attempts to classify high-speed still photography as an exposure duration of less than 1/1000 second, was then based on the acceptable limit of mechanical shutters in ordinary cameras. Today, electronic flash has further shortened exposure duration for still cameras and in light of current practice a 1/10,000 second limitation now exists.

Photographic Recording Instruments Are Currently Classified in the Following Terms:

1) Mode of Operation (Intermittent, Continuous-Writing Framing Camera, Image Dissection Cameras).

2) Speed of Operation (Pulse Operation, High-Speed, Ultra High-Speed).

3) Type of Application (Ballistic, General Purpose, Missile Tracking).

4) Special Features (Tracking Telescope, Time Resolving Spectrography).

5) Format and/or Length of Record (16-mm full frame, 1,000 foot capacity).

The Operating Modes of Framing Cameras May be Categorized as Follows:

Class A. Single Exposure, Framing.

Still Camera with some means of controlling duration of exposure. (Built-in auxiliary mechanical shutter, or an inertialess auxiliary shutter such as a Kerr Cell, or an electronic flash or spark gap used "open flash." (Pulse and Image-Motion Compensating Cameras fall into this class).

Class B. Multiple Exposure, Framing.

Still camera, may be equipped with a repetitive mechanical shutter or "light chopper" (A repetitive electronic flash unit), or a flashing light attached to the subject.

Ballistic Cameras fall in this category.

Class C. Continuous Writing, Multiple Framing

A Sequential Framing Camera. Camera makes a number of discrete photographs on a length of film.

Class E. Intermittent Writing, Multiple Framing.

Camera mechanism is sequential and cyclical, like continuous-writing cameras (Class C).

Difference--Camera is alternatively alert (capable of recording an image) and alternatively blind (not capable of recording an image).

Cycle is achieved through use of a flat mirror which places a series of discrete images in a stationary arc on the film, then turns over to the "blind" phase. The Barr and Stroud Model CP15 Ultra High-Speed Camera is an example of this class.

Event Classification

Factors that influence the selection of a photographic recording instrument is the event.

Type I. Continuous. An Event which proceeds as an uninterrupted activity.

Example: Air flowing past a test specimen as in a wind tunnel or the rotation of a wheel.

Type II. Controlled. An Event that may be initiated on demand and which responds in an orderly, reliable manner, as for example--An electrically detonated explosive reaction, the operation of an electric solenoid.

Optical-Mechanical arrangement is such that the frames are exposed to whatever is in front of the lens in a cycle that repeats continuously as long as the camera is in operation.

Usually used with an electronic flash unit having a duration less than the time it takes the camera to complete a cycle.

Result: Short length of film with a series of sequential images--each exposed during a small fraction of the electronic flash discharge, but overall covering the span of the flash.

Drum Cameras--such as the Beckman & Whitley (now Cordin), Dynafax is in this category.

Class D. Transitory Writing Multiple Framing.

Most "Normal Speed" and "High-Speed" Motion Picture cameras fall into this category. They record a finite series of frames throughout a single finite interval of time. Certain image-dissecting cameras which achieve their high speeds by dissecting the image into small increments throughout the plate, could be considered a cross-breed of Class B and Class D cameras--The Courtney-Pratt Series 600 is a good example.

Type III. Repetitive. Event Recurs at Intervals.

Two Types: Periodic and Irregular.

Repetitive Event: Periodic Type.

Has programmed intermittency, by nature it recurs at predetermined intervals.

Example: Firing of an internal combustion engine; the recoil of an automatic machine gun.

Repetitive Event: Irregular Type.

May be random or nearly so.

Example: Formation of cavitation bubbles at a ships propellor.

Type IV. Announced.

Announced event signals its forthcoming occurrence.

Example: Leader stroke lighting that precedes the main discharge; rapid increase in brightness that is followed by the burning out of a lamp filament.

Type V, Spontaneous,

Event initiates without warning, external control or guidance. (As if governed by laws of nature, internal impulse or chance).

Two Types: Natural and Incited.

Natural Spontaneity is self initiating. (Operator has little or no control).

Example: Flight Behaviour of an insect.

Incited Spontaneity may be prompted by operator but occurs in an unscheduled manner.

Example: The cracking of brittle material under a static load.

The conditions that will inevitably result in the materials cracking can be set-up in advance by the operator but he has no control over or advance knowledge of when the actual cracking will occur.

Certain classes of photographic recording instruments are not compatible with all types of events due to problems of synchronization.

Camera Type	Frames/ft	Frames/100'	Frames/200'	Frames/400'
16-mm Cameras	40	4,000	8,000	16,000
35-mm Cameras	16	1,600	3,200	6,400
70-mm [Flight Research]	5.128	512	1,025	2,051
[Taking Frame Line into Consideration]	5.3	530	1,060	2,120
70-mm Hulcher				
Model 100	2.33	233		
Model 102	4.66	466		
Dynafax Model 326	[224 16-mm frames on 35-mm unperforated film 33 inches long]			

Photo-Instrumentation Glossary

The terms and definitions presented here were developed by the Glossary Subcommittee of the SMPTE Photo-Instrumentation Engineering Committee. The Subcommittee was charged to define those terms generally used in the photo-instrumentation discipline, but for which there were no accepted definitions.

Cinematography. (a) Photography in which a series of photographs of uniform size is taken so that the motions of the subject can be recreated by rapid sequential viewing. (b) The entire complex of activities involved in the staging, direction, photography, editing and presentation of motion pictures. (c) Motion-picture photography.

Continuous Access. A photographic system which records an image continuously during its exposure cycle with no blind periods.

Continuous Writing. Describing a photographic system which, when running, is always able to accept light and to make an exposure; usually used in reference to rotating-mirror cameras with this capability, to distinguish them from those with a significant blind period during some part of a mirror revolution.

Direct Shadowgraph. A shadowgraph wherein no image-forming optical elements are employed, and a silhouette image of the view field is cast directly upon either a photosensitive material or a viewing screen. (See Shadowgraph.)

Drum Camera. A photographic device utilizing the inside or outside of a rotating drum to support and move the photosensitive recording medium through the focal plane of a lens.

Electronic Flash. A device, which upon command produces a pulse of luminous energy caused by a discharge of electrical energy through a gas. The term usually implies the use of a flashtube and associated power source and trigger circuit.

Flashtube. A sealed, transparent tube with two or more electrodes filled with a suitable gas or vapor such as xenon or mercuric vapor, at less than half an atmosphere of pressure through which an electrical discharge is passed to obtain a pulse of luminous energy.

Focusing Shadowgraph. A shadowgraph wherein focusing optical elements are interposed between the object field and the photosensitive material, the viewing screen, or the viewing optical system. (See Shadowgraph.)

Framing Camera. A camera which records sequential photographs of uniform format. The dimensions of the format are determined by the size of the frame.

Guided Spark. An electrical discharge between two electrodes whose path is guided or constrained by the presence of a dielectric material or gas jet.

High-Speed Photography. Photography in which picture taking rates range from 100 to 10,000 frames per second, writing rates range from 10^{-3} to 10^{-1} mm per microsecond, or exposure times range from 10^{-3} to 10^{-6} seconds.

Image Dissection. Any optical, mechanical or electronic process, or any combination of such processes, whereby an optical image is subdivided into discrete segments prior to being photographed, recorded, transmitted, or otherwise processed.

Image-Motion Compensation. Any system whereby relative motion between the image and the photosensitive material in which the image is to be recorded is reduced or eliminated.

Pulse Camera. A camera designed to operate a frame at a time in response to a command such as an electrical pulse. Each command causes a sequence of events that exposes a single frame, advances the film, and performs all other operations necessary to ready the camera for the next frame.

Rotating-Mirror Camera. A camera employing a (rapidly) rotating mirror to deflect the image-forming light beam. Usually the image is formed on stationary film and the technique is used when the writing rate required is higher than that obtainable with moving film.

Rotating-Prism Camera. A framing camera employing a rotating, parallel-sided prism to move the image-forming light beam at the same speed as the continuously moving film during the exposure of a frame.

Schlieren. An optical system producing images whose illumination or hue at a given point is related to the angular deflection incurred by a light ray in passing through the corresponding object point. The object is back-illuminated and a straight-edge, circular aperture, or graded density filter or multicolored filter is used in the system to discriminate between deflected and undeflected rays.

Shadowgraph. A device arranged in such manner as to enable photography and/or visual observation of the silhouette of back-illuminated objects placed within the object field of the device and of gradations in luminous intensity resulting from variations in the opacity or in the index of refraction of media contained within the object field. (See Direct and Focusing Shadowgraphs.)

Spark Source. A device used to produce a short-circuit pulse of luminous energy by an electrical discharge between two closely spaced electrodes either in air or in a controlled atmosphere at a pressure usually greater than half an atmosphere.

Still Photography. Photography that provides a single photograph.

Streak Camera (Smear Camera — a less popular term for streak camera). A camera in which the image is made to sweep along the film, or vice versa. Usually used with an essentially line-like object, or one made so by masking with a slit, so that the photograph is a record of events along the slit versus time.

Streak Photograph. A photograph made by a streak camera.

Synchro-Ballistic (Also referred to as Ballistic-Synchro but this term is less acceptable). A form of image-motion compensation used primarily in ballistic photography, in which the recording medium (i.e. film) is moved in approximate coincidence with the optical image.

Time-Lapse Photography. A motion-picture technique used to achieve a time magnification of less than unity. The original exposures are made at a frame rate slower than normal and are then projected at the normal rate. The result is an apparent speed-up of the original action.

Time Resolution. The ability of an instrument or technique to measure time. The smallest time interval that can be measured by use of a given recording system.

Very-High-Speed Photography. Photography in which picture taking rates range from 10,000 to 1,000,000 frames per second, writing rates range from 10^{-1} to 10 mm per microsecond, or exposure times range from 10^{-7} to 10^{-6} seconds.

Ultra-High-Speed Photography. Photography in which picture-taking rates exceed 1,000,000 frames per second, writing rates exceed 10 mm per microsecond, or exposure times are less than 10^{-7} seconds.

["Reprinted by permission from the Journal of the SMPTE, June 1969" Letter dated February 24, 1975 from Barbara McMahon, Publication Dept, SMPTE].

EXPOSURE TIME

Each of the various types of rotary prism cameras have a slightly different exposure cycle which varies between 1/3 and 1/5 the reciprocal of the picture taking rate. These cameras have 2, 4 or 8 sided prisms. Cameras without additional shutters have an exposure time as follows:

16 mm Fastax 4 sided prism	$\dfrac{1}{3 \text{ x frame rate}}$
16 mm Fastax 2 sided prism	$\dfrac{1}{5 \text{ x frame rate}}$
16 mm Fastair	$\dfrac{1}{4 \text{ x frame rate}}$
Hycam	$\dfrac{1}{2.5 \text{ x frame rate}}$

Manufacturers' literature should be referred to for the exposure time of specific camera models.

Some Fastax cameras have provision for the installation of a slotted mask between the rotating prism and the film. These slotted masks are reduced in height in increments down to .003 of an inch. These slotted masks also reduce the frame height in proportion to the mask height. The manufacturer claimed that the mask is analogous to that of a focal plane shutter in that the narrower the slit the shorter the exposure time on the film. Actually, the exposure time for the frame is reduced because the frame height is reduced. For motion stopping ability the slits are almost useless.

For Example: A howitzer projectile traveling at 1850 ft./sec was photographed with two Fastax cameras

operating at 8,000 frames per second. One camera had a standard aperture and the other was equipped with an .03 inch slit. Both cameras had identical image motion during exposure. The motion was across the width of the film.

Photo-Sonics rotary prism cameras have an additional rotary disc shutter which produces a shuttering action that is similar to the intermittent motion film cameras. Some Photo-Sonics camera shutters are marked with the fraction of the degree of shutter opening. Exposure on the film may be any of 5 values for a given frame rate according to the shutter opening selected. The shutter calibration is in relative values of 9°, 18°, 36°, and 72° to simplify exposure calculations. Where acceleration forces are not severe the camera may be equipped with an adjustable shutter assembly which may be manually set to any of the above openings.

Film Running Times

Film running time is based on the camera's framing rate and the length of film utilized. Rotary prism cameras such as the Fairchild HS-100, HS-101, Fastax, Eastman High-Speed [Magnifax], have an accelerating picture taking rate for the length of the film run. Several rotary prism cameras such as the Fastair, Photo-Sonics 1B, 1C (16-mm), 4B, 4C (35-mm), Nova, Hycam and Photec IV camera are theoretically capable of operating at a controlled speed for the length of the film run after the initial period of acceleration. (Note: Calibration charts should be constructed using time base generator to determine the actual film running times of these cameras).

EXPOSURE TIME

SHUTTER OPENING DEGREES	FRAMES PER SECOND								
	8	16	24	32	48	64	72	100	200
5	1/576	1/1152	1/1728	1/2304	1/3456	1/4608	1/5184	1/7200	1/14400
10	1/288	1/576	1/864	1/1152	1/1728	1/2304	1/2592	1/3600	1/7200
15	1/192	1/384	1/576	1/768	1/1152	1/1536	1/1728	1/2400	1/4800
20	1/144	1/288	1/432	1/576	1/864	1/1152	1/1296	1/1800	1/3600
25	1/115	1/230	1/345	1/460	1/691	1/922	1/1037	1/1440	1/2880
30	1/96	1/192	1/288	1/384	1/576	1/768	1/864	1/1200	1/2400
35	1/82	1/164	1/247	1/329	1/594	1/658	1/741	1/1030	1/2060
40	1/72	1/144	1/216	1/288	1/432	1/576	1/648	1/900	1/1800
45	1/64	1/128	1/192	1/256	1/384	1/512	1/576	1/800	1/1600
50	1/57	1/115	1/173	1/230	1/345	1/461	1/518	1/720	1/1440
60	1/48	1/96	1/144	1/192	1/288	1/384	1/432	1/600	1/1200
70	1/41	1/82	1/123	1/164	1/247	1/329	1/370	1/514	1/1028
80	1/36	1/72	1/108	1/144	1/216	1/288	1/324	1/450	1/900
90	1/32	1/64	1/96	1/128	1/192	1/256	1/288	1/400	1/800
100	1/29	1/57	1/86	1/115	1/173	1/230	1/259	1/360	1/720
110	1/26	1/52	1/78	1/104	1/157	1/209	1/235	1/327	1/654
120	1/24	1/48	1/72	1/96	1/144	1/192	1/216	1/300	1/600
130	1/22	1/44	1/66	1/88	1/133	1/177	1/200	1/277	1/554
140	1/20	1/41	1/62	1/82	1/123	1/64	1/185	1/257	1/514

EXPOSURE FORMULAS

$$\text{Exposure Time/Seconds} = \frac{\text{Shutter Opening (Degrees)}}{360 \times \text{Frames Per Second}}$$

$$\text{Shutter Opening} = \text{Exposure Time/Seconds} \times \text{F.P.S.} \times 360$$

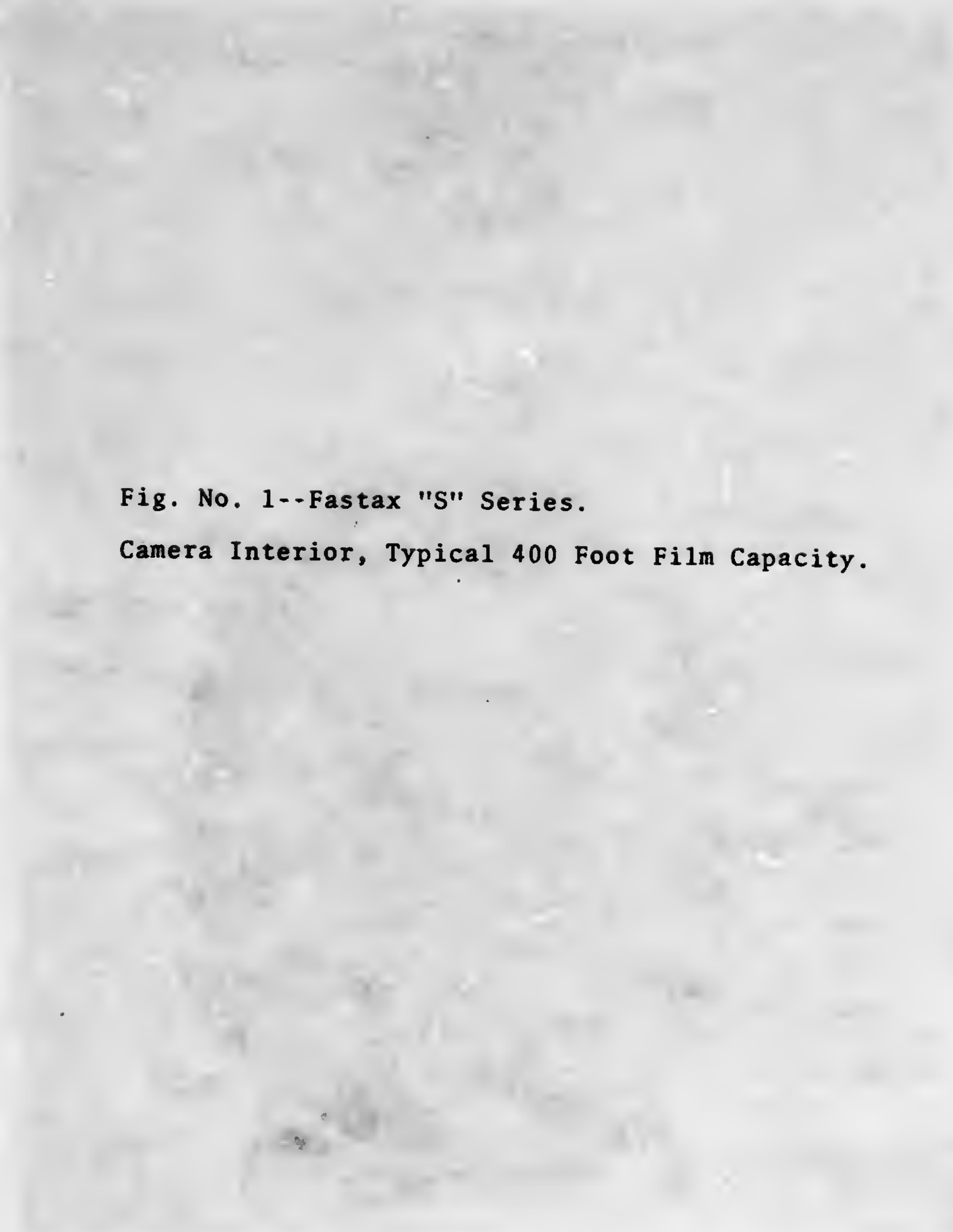


Fig. No. 1--Fastax "S" Series.

Camera Interior, Typical 400 Foot Film Capacity.

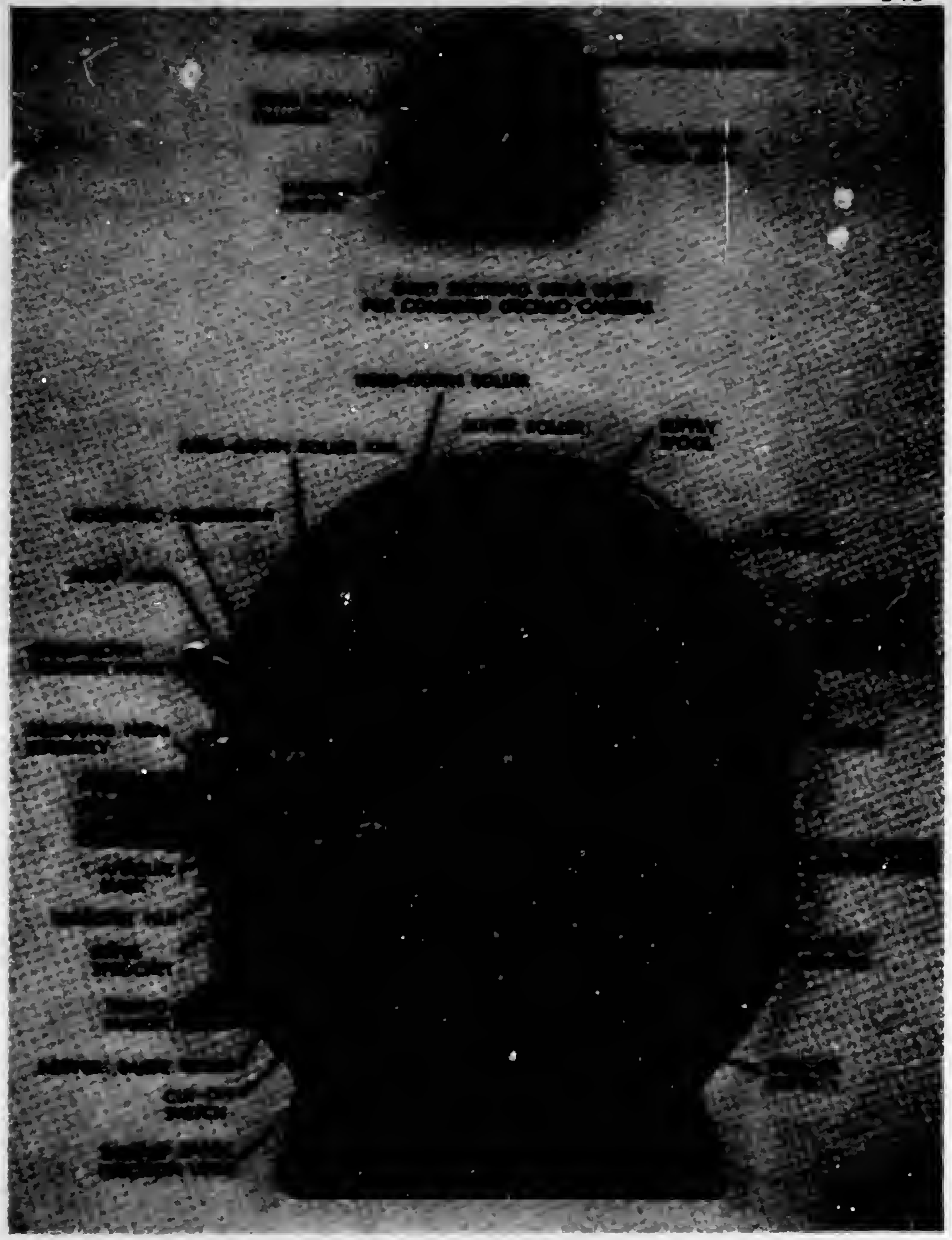


Fig. No. 2--Fastax Camera Optical System

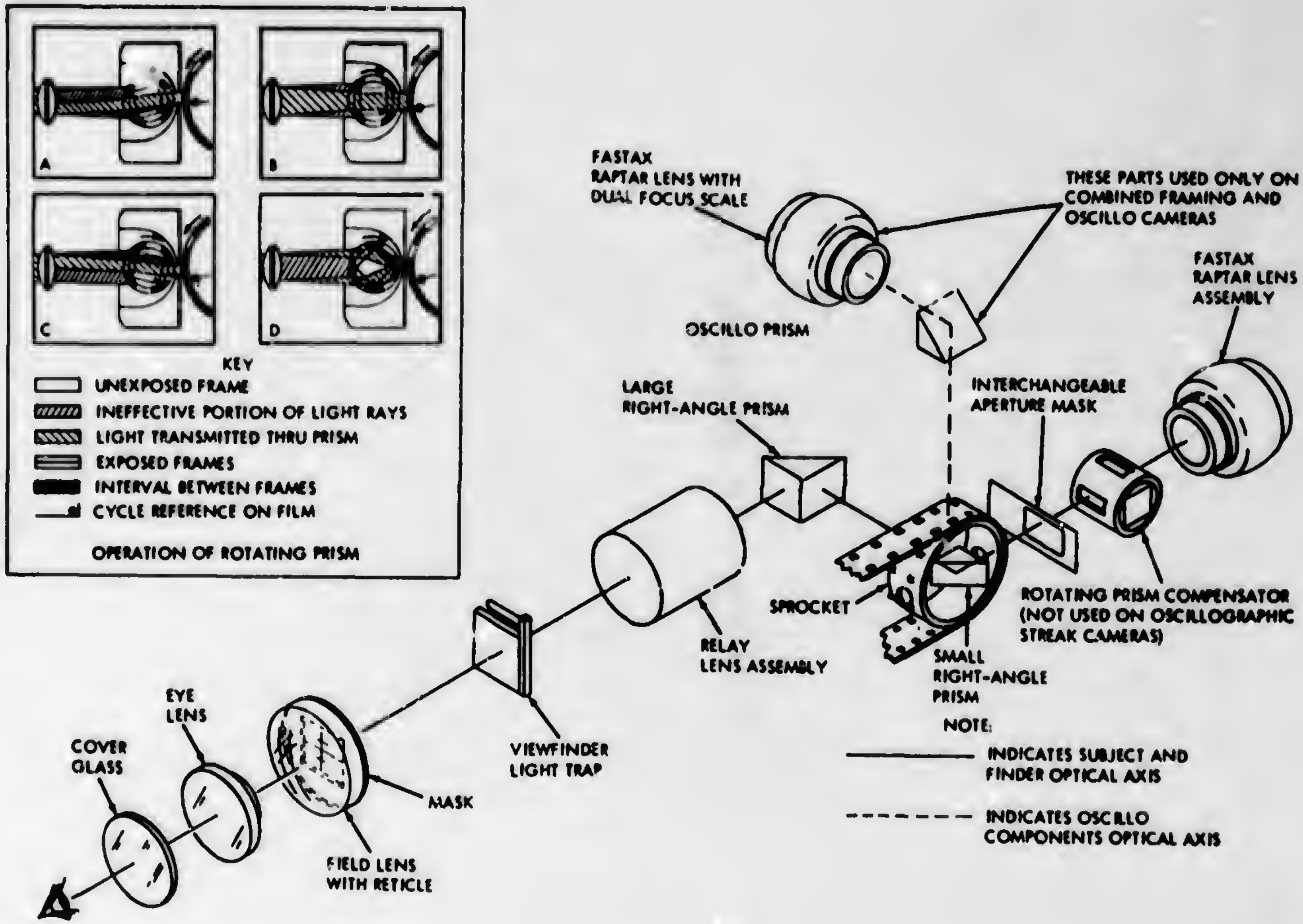
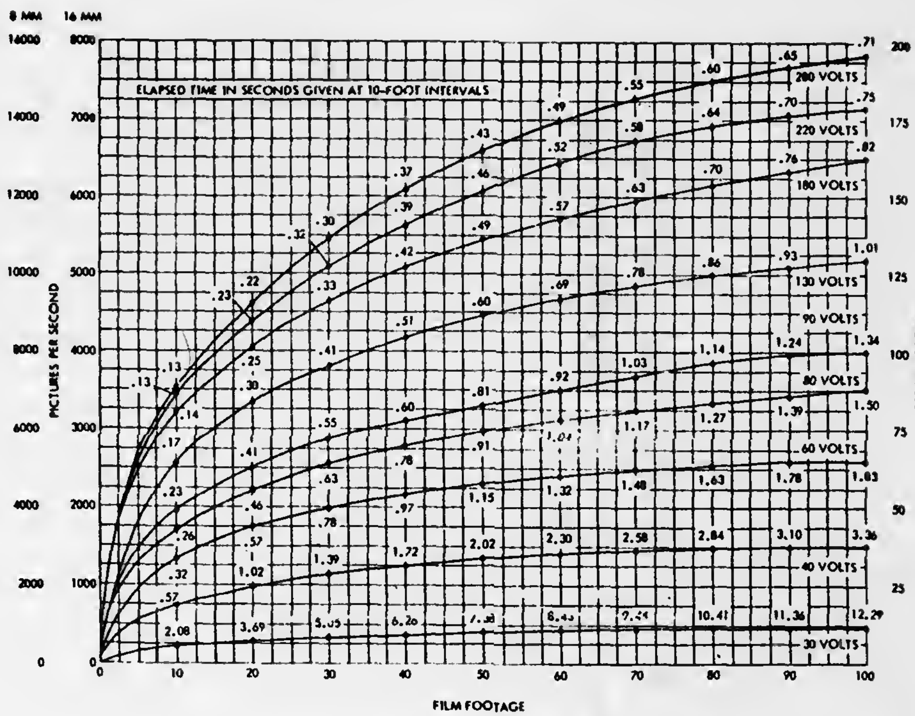

A
B
C
D
KEY
UNEXPOSED FRAME
INEFFECTIVE PORTION OF LIGHT RAYS
LIGHT TRANSMITTED THRU PRISM
EXPOSED FRAMES
INTERVAL BETWEEN FRAMES
CYCLE REFERENCE ON FILM
OPERATION OF ROTATING PRISM
FASTAX RAPTAR LENS WITH DUAL FOCUS SCALE
THESE PARTS USED ONLY ON COMBINED FRAMING AND OSCILLO CAMERAS
FASTAX RAPTAR LENS ASSEMBLY
OSCILLO PRISM
LARGE RIGHT-ANGLE PRISM
INTERCHANGEABLE APERTURE MASK
SPROCKET
ROTATING PRISM COMPENSATOR (NOT USED ON OSCILLOGRAPHIC STREAK CAMERAS)
RELAY LENS ASSEMBLY
SMALL RIGHT-ANGLE PRISM
EYE LENS
COVER GLASS
VIEWFINDER LIGHT TRAP
MASK
FIELD LENS WITH RETICLE
NOTE:
INDICATES SUBJECT AND FINDER OPTICAL AXIS
INDICATES OSCILLO COMPONENTS OPTICAL AXIS

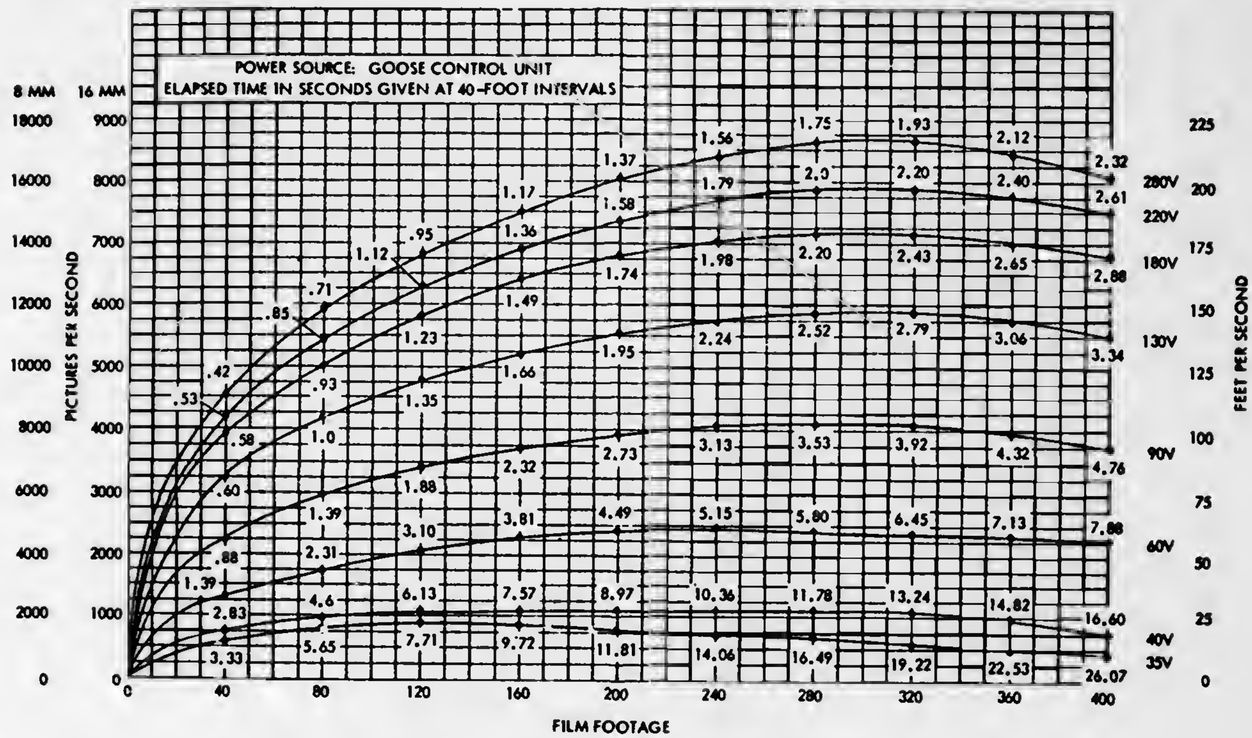
Fig. No. 3--A-C Speed Curves and Power Requirements for Category I Fastax Cameras.



A-C Power Requirements of Category I Cameras

Voltage Applied	Initial Current	Surge Current	Nominal Current	End Current
60 volts	2.3 amps	7.5 amps	5 amps	4.6 amps
90 volts	3.5 amps	15.5 amps	7 amps	6.0 amps
130 volts	5.5 amps	26.5 amps	15 amps	8.8 amps
220 volts	8.5 amps	34.0 amps	20 amps	13.0 amps
280 volts	11.0 amps	31.8 amps	15 amps	15.5 amps

Fig. No. 4--A-C Speed Curves and Power Requirements for Category II Fastax Cameras.



A-C Power Requirements of Category II Cameras

Voltage Applied	Initial Current	Surge Current	Nominal Current	End Current
60 volts	-----	7.7 amps	5 amps	5.1 amps
90 volts	3.2 amps	13.0 amps	8 amps	7.8 amps
130 volts	5.5 amps	16.0 amps	12 amps	11.7 amps
220 volts	8.5 amps	31.5 amps	20 amps	15.0 amps
280 volts	10.0 amps	30.5 amps	20 amps	19.5 amps

Fastax Camera 16-mm WF-3 and WF-4

1. Inspect camera interior for cleanliness.
   a. After each roll of film exposed.
   b. Remove dirt and film chips.
   c. Check hold down roller for emulsion buildup.
   d. Clean with orangewood stick or fingernail, [DO NOT USE ANY METALLIC OBJECT].

2. Check prism for finger marks.
   a. Use "Q" tipe moistened in aqueous solution of alcohol to clean. Wipe with water moistened "Q" tip.

3. Check all lenses.
   a. Remove dust from front and real elements.
   b. All lenses must be properly seated.

4. Note: USE BALANCED ALUMINUM SPOOLS
   a. Camera operating efficiency is reduced and camera damage may result due to upset of dynamic balance by use of other type of spools.
   b. Discard all bent or imperfect spools.

5. Load camera with proper film as required by project.
   a. Use high-speed perf film only.

6. Do not operate camera without film.

7. Connect all power and timing cables securely.

8. Check timing lights for operation.

9. Focus and set lens to proper F/stop.
   a. Lens should be seated flush in mount.

10. Camera power swith on camera body to "ON."
    a. Note: DO NOT OPERATE CAMERA MANUALLY ABOVE 130 VOLTS.

TROUBLE SHOOTING CHART

DOOR WON'T CLOSE:

Check film hold down roller; must be pressed down to ride on sprocket before door will close properly.

Photo-Sonics 16-mm. 1-B, 1BAC, 1C [24vdc, 115vac]

1. Affix camera to mount or tripod as required.
2. Mount lens securely--Boresight, frame and focus lens.
3. Attach camera power and timing cords, and remote lines.
   a. Set timing CPS when using timing generator. Visually check timing light operation.
4. 1B--Attach 115 v AC control box. Adjust variac for desired DC volts. Use battery for DC operation. NOTE: Cameras operating on DC voltage--DO NOT PLUG DIRECTLY INTO AC VOLTAGE AT ANY TIME.
   1BAC--115 volts AC 50-60 cycle.
5. Compute and set your f/stop
6. Briefly power check your camera.
   a. If camera does not operate on checkout--ARE YOU DEPRESSING THE BUCKLE SWITCH WHICH MAY BE AN INTEGRAL PART OF THE CAMERA?
   b. Control Box. Remote switch must be in the "OFF" position for remote operation.
7. 1B--DO NOT RUN CAMERA WITHOUT FILM ON MORE THAN 24vDC; DO NOT RUN CAMERA WITH FILM ON VOLTAGE MORE THAN 50vDC.
   1BAC--Camera should not be run without a load except for short period of checkout.
8. Install Magazine.
   a. 1B--Align sprocket drive shaft "dots" on the camera and magazine sprocket shaft, and magazine sprocket shaft dots on the magazine.
9. Snug all bolts on the magazine.
   a. IS MAGAZINE PROPERLY SEATED?
   b. Turn film through by hand to insure ease of operation.
   c. Take up all slack to prevent breakage of film at start.
10. 1BAC: Direct drive assembly produces 1000 fps at 115 vAC.
    a. Speed changes. Gears on motor shaft and its mate on the take-up may be varied to obtain desired speeds.

GEAR SELECTION

fps	Camera	Motor
200	2	1
400	4	3
600	6	5
800	8	7
1000	10	9

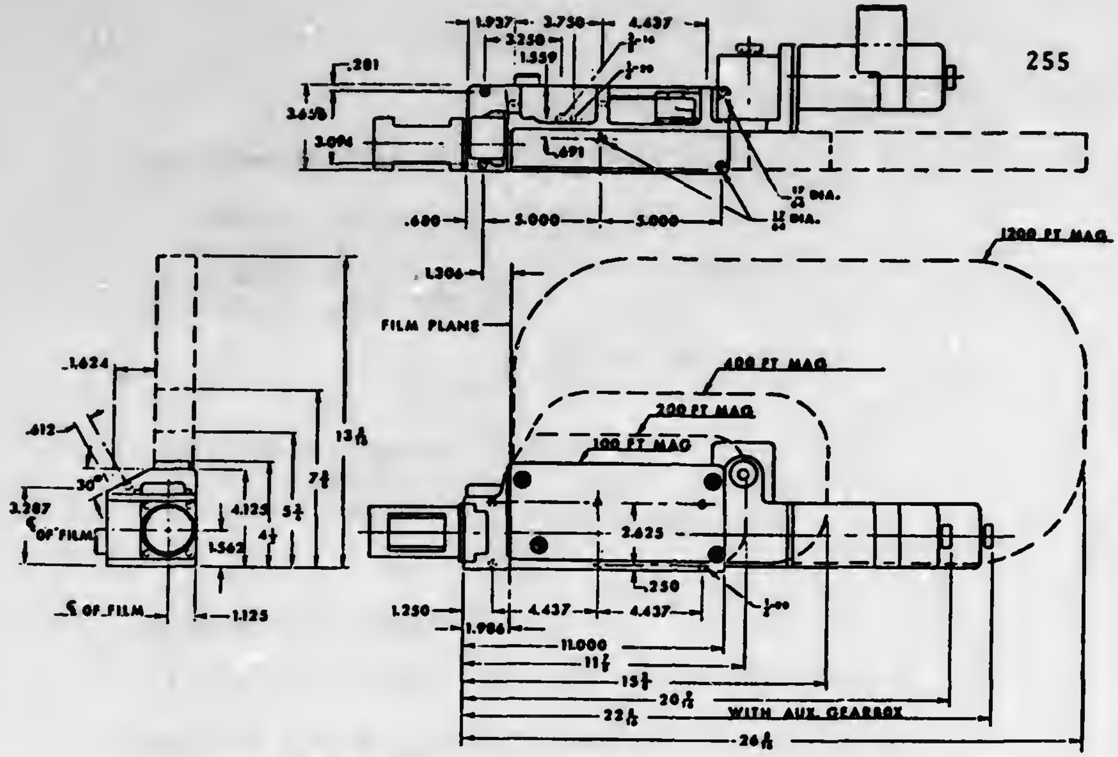
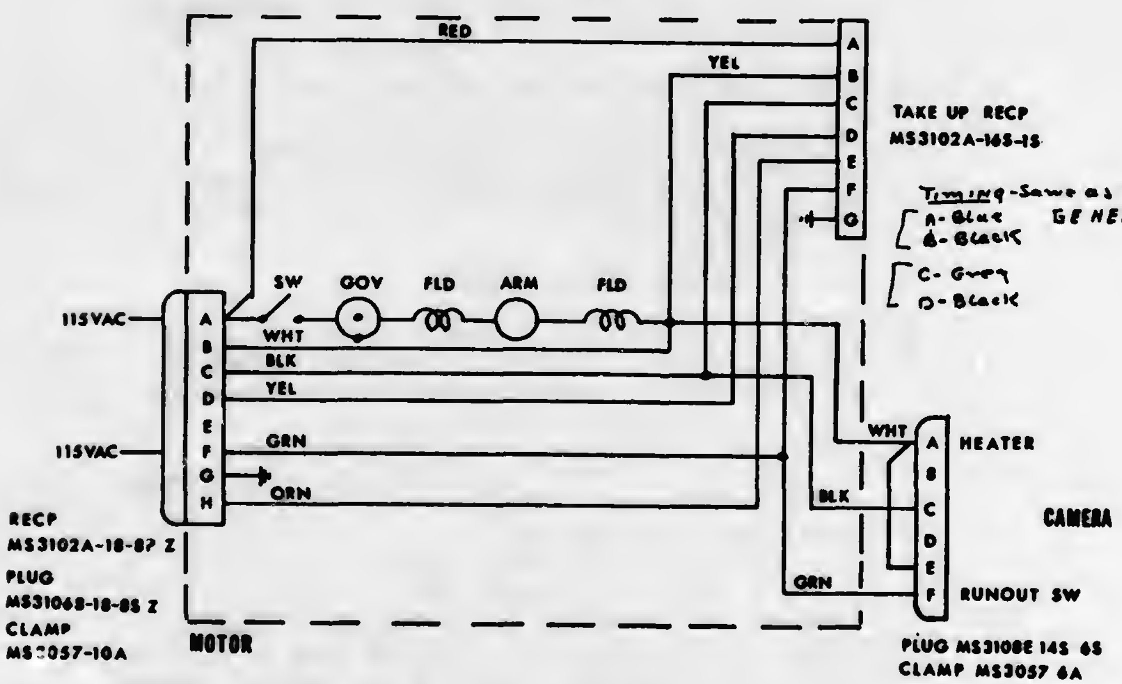


Photo-Sonics Camera 1BAC--16-mm

DIMENSIONS



WIRING DIAGRAM

Photo-Sonics Camera 35-mm. 4B and 4C

1. Clean equipment and check that all components are available.
   a. Control box, magazine assemblies, automatic take-up and brake assembly, drive motor and transmission on assembly, camera assembly and all connecting cables, magazines, lenses, etc.

2. Load Magazine in darkroom.
   a. Must be clean of film chips.

3. Mount camera and assemble components as required.
   a. Connect all cables, power, timing.
   b. For remote operation--on/off switch--must be in the OFF Position.

4. Select proper frame rate.
   a. Adjust selector ring on transmission assembly.

5. Boresight camera, focus and frame on test object.

6. Load camera: Sprocket holes of film must be properly seated on sprocket otherwise film breakage will occur.
   a. Camera door will not close unless film is properly threaded into camera and film keepers are closed.

7. Take a meter reading and set you f/stop.

8. For ballistic synchro or streak technique:
   a. Replace shutter with proper slit aperture.
   b. Check film threading instruction. Properly thread camera.

TROUBLE SHOOTING GUIDE

1. Film jams and buckles in camera--CHECK THREADING.
2. Film breaks and jams during high-speed operation.
   a. FPS Selector switch incorrectly set; reset to 1500, 2000, 2500 position.
3. Camera continues to run after film runs out.
   a. Film chips jamming run out switch; stop camera, clean film chips out.
4. Timing Marks not on film.
   a. Time lights burned out, replace.
   b. Check electrical connections.

Note: The 4B and 4C camera are basically the same. Primary difference: 4C camera magazine is tilted back so that nothing protrudes beyond the front surface of the camera. Useful when using large lenses. Keep all camera components together. Lens mounts are interchangeable.

Photo-Sonic 1B, 1C and 4B Cameras.

Frames Per Second	Shutter Degree 9°	18°	36°	72°
4000	1/160,000	1/80,000	1/40,000	1/20,000
3500	1/140,000	1/70,000	1/35,000	1/17,500
3000	1/120,000	1/60,000	1/30,000	1/15,000
2500	1/100,000	1/50,000	1/25,000	1/12,500
2000	1/80,000	1/40,000	1/20,000	1/10,000
1500	1/60,000	1/30,000	1/15,000	1/7,500
1000	1/40,000	1/20,000	1/10,000	1/5,000
800	1/32,000	1/16,000	1/8,000	1/4,000
600	1/24,000	1/12,000	1/6,000	1/3,000
500	1/20,000	1/10,000	1/5,000	1/2,500
400	1/16,000	1/8,000	1/4,000	1/2,000
300	1/12,000	1/6,000	1/3,000	1/1,500
200	1/8,000	1/4,000	1/2,000	1/1,000
100	1/4,000	1/2,000	1/1,000	1/500
50	1/2,000	1/1,000	1/500	1/250

Photo-Sonic 35-mm 4B

#115 Volt Moter

*240 Volt Motor

FPS	FEET 100	200	300	400	500	1000
# 250	6.4 sec	12.8	19.2	25.6	32.0	64.0
# 500	3.2	6.4	9.6	12.8	16.0	32.0
# 750	2.1	4.2	6.4	8.5	10.6	21.3
* 1000	1.6	3.2	4.8	6.4	8.0	16.0
# 1250	1.2	2.5	3.8	5.1	6.4	12.8
* 1500	1.0	2.1	3.2	4.2	5.3	10.6
* 2000	0.8	1.6	2.4	3.2	4.0	8.0
* 2500	0.6	1.2	1.5	2.5	3.2	6.4

Hycam Model K2001R High-Speed Motion Picture Camera

It is a full-frame 16-mm 100 foot capacity camera capable of from 100 to 9,000 pictures per second. A direct upright viewfinder (5x), an event synchronizer built-in rectifier cut-off switch and single timing light assembly is included. The camera takes standard C-mount lenses of any focal length and has an 8-sided prism, sprocket and shutter on on shaft. [Camera comes equipped with a 1/2.5 shutter].

Resolution.--Center 68 lines/mm, vertical and horizontal; Edges 56 lines/mm, vertical and horizontal.

Hycam--400' Capacity High-Speed Motion Picture Camera

The Hycam optical head utilizes a unique optical system consisting of the film sprocket, rotating prism and shutter on a single shaft driven by the film--in effect simulating a drive belt from the take-up motor.

The speed control is a solid state electronic closed loop servo system which can be manually set to control frame rate (See functional diagram of Hycam Electronic Speed Control). The 115 volt Hycam operates on 115 volts AC, 60Hz, 20 amp power source; in the unregulated range a 30 amp source is required. Caution: The Hycam Power Cord and outlet is a standard 3-wire grounded system, and the ground wire should be terminated to a proper electrical ground.

Camera Controls

H-L Speed Reducer Lever--the high range is indicated by "H." The take up spindle in this mode is coupled to the

camera motor with a 1:1 ratio for frame rates above 100 pps. The Low Range is indicated by "L." The take-up spindle in this case is geared down for frame rates below 100pps.

H-L Servo Brake Lever--The "H" setting is used for frame rates over 1,000--"L" setting for under 1,000pps.

Drag Brake Control--Set drag brake at 30 for frame rates below 1,000pps and at 0 for frame rates above 1,000pps. NOTE: Before setting the drag brake control, rotate it as many turns as necessary to bring drag brake flush with the drag brake housing. Then rotate the drag brake control to the desired "0" or "30" setting.

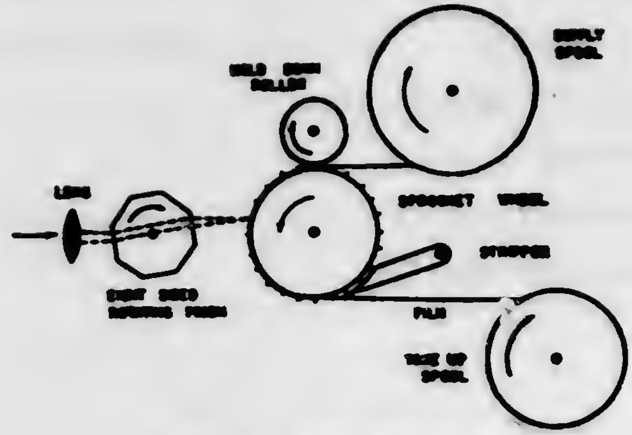
PPS Dial: The PPS Dial is used to set frame rates in conjunction with the muliplier switch for frame rates in the regulated range. Dial control has three number wheels; tens of digits, digits, and tenths of a digit. Use lock lever at bottom of dial to prevent accidental changes.

MULTIPLIER SWITCH: For regulated frame rates, the frame rate is the PPS reading multiplied by the multiplier switch for the appropriate format. Example: 4,000 pps full frame 16-mm format. Set pps dial at 40.0 and multiplier switch to x100. Upper x100 marking indicates a multiplication of 100. the lower "H" marking indicates the speed reducer should be set at "H" for proper gear ratio. PPS Dial will read direct frames only when operating with full-frame 16-mm format and multiplier switch at X1. Caution: DO NOT CHANGE MULTIPLIER SWITCH WHEN CAMERA IS RUNNING--ARCING WILL BURN OUT CONTACTS.

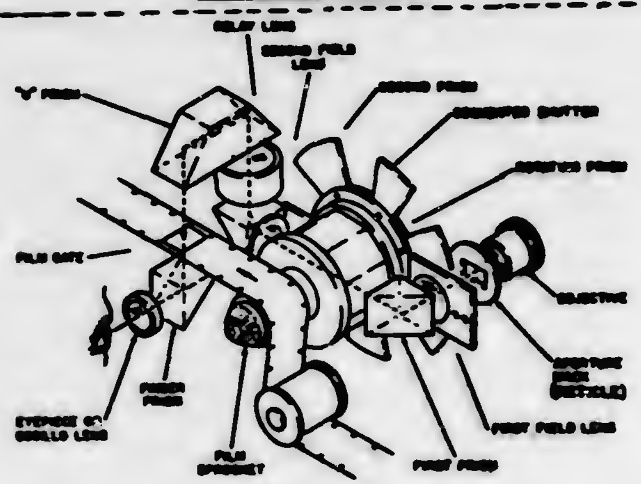
Camera Start/Stop Switch.

The camera switch connects the motor in the "Start" position to AC Voltage. NOTE: THIS SWITCH SHOULD NOT BE THROWN TO "START" UNTIL UNIT HAS BEEN PLUGGED INTO LINE POWER FOR AT LEAST 10 SECONDS. This allows the electronic control circuitry to stabilize. The remote control outlet is in parallel with the samera start/stop switch and allows remote stop and start activation.

For additional information regarding this camera see the Hyacm Instructional Manual.



Fastax 8mm rotary prism.



Hycam optics.

Fig. No. 5--Comparison of optical system between Fastax 8-mm Rotary Prism Camera and Hycam 16-mm High-Speed Camera.

Fig. No. 6--Hycam Model K2001R.

Hycam High-Speed Motion Picture Camera (100ft. Capacity), with High-Speed Camera Regulator Model HSCR-2.

Note: This camera is no longer manufactured.

Fig. No. 6--Hycam Model K2001R.

Hycam High-Speed Motion Picture Camera (100ft. Capacity), with High-Speed Camera Regulator Model HSCR-2.

Note: This camera is no longer manufactured.

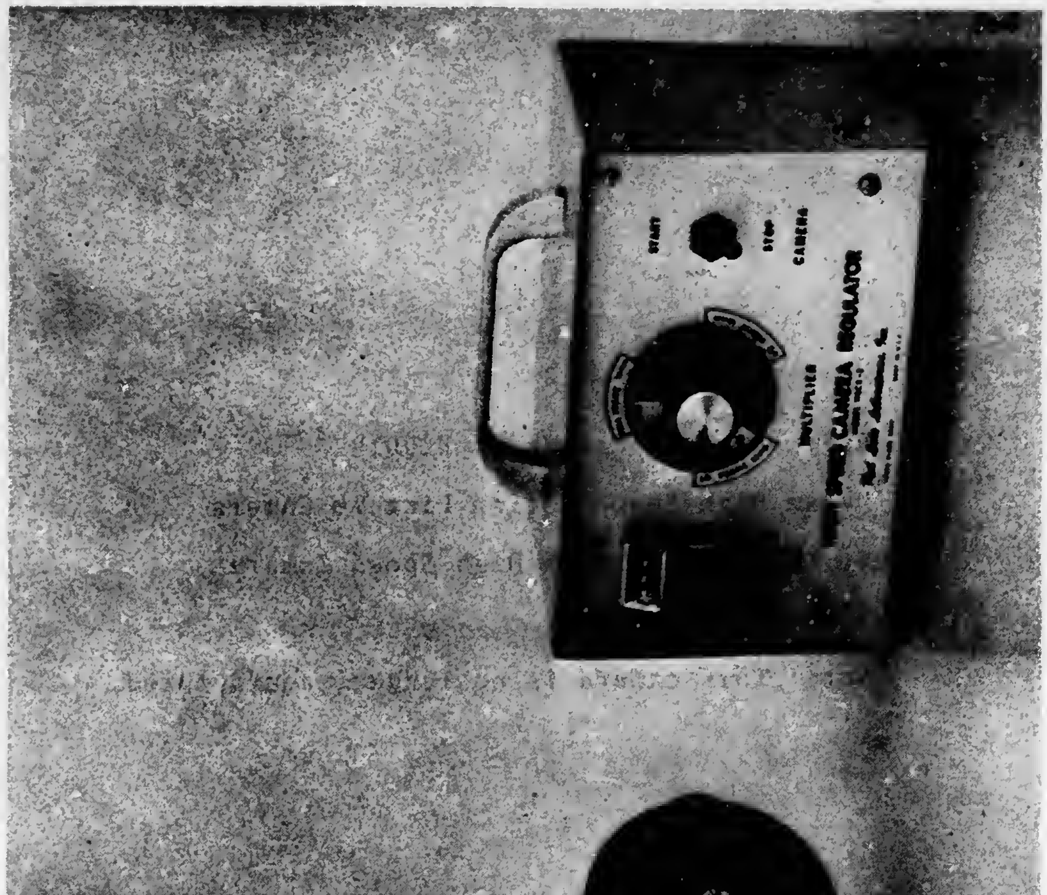

START
STOP
CAMERA
MULTIPLIER
SPEED CAMERA REGULATOR

Fig. No. 7--Hycam High-Speed Motion Picture Cameras: 2,000 ft, 400 ft, and 100 ft models.

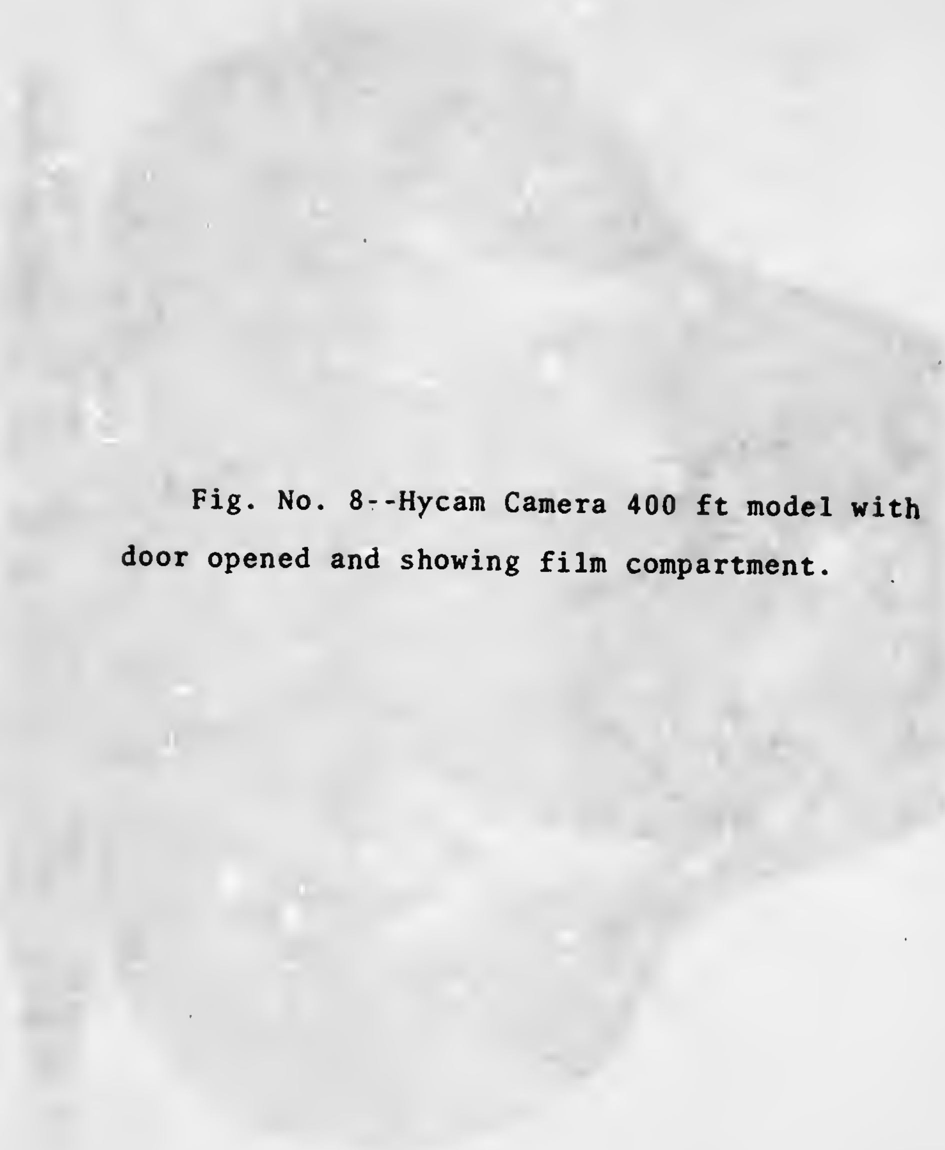
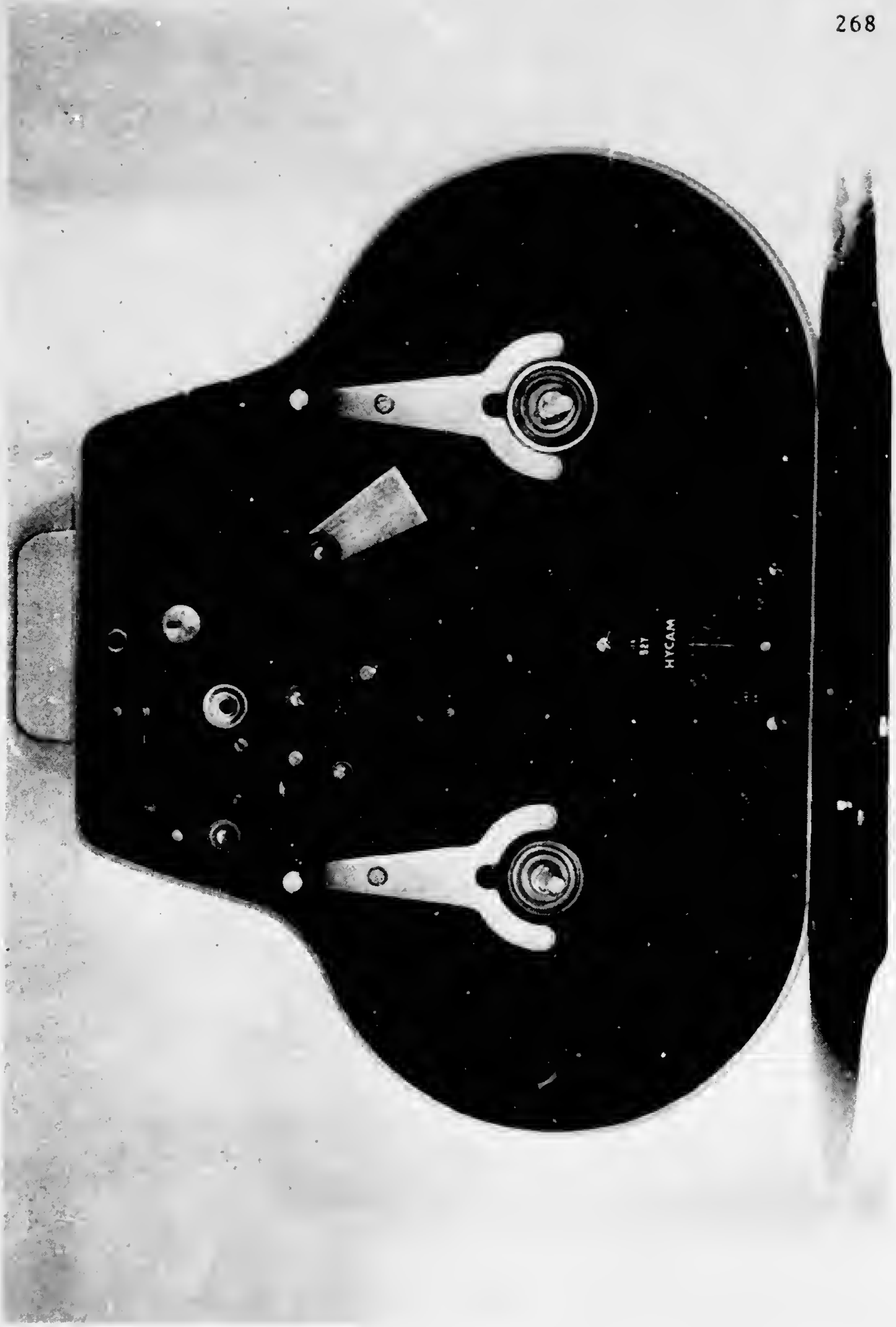
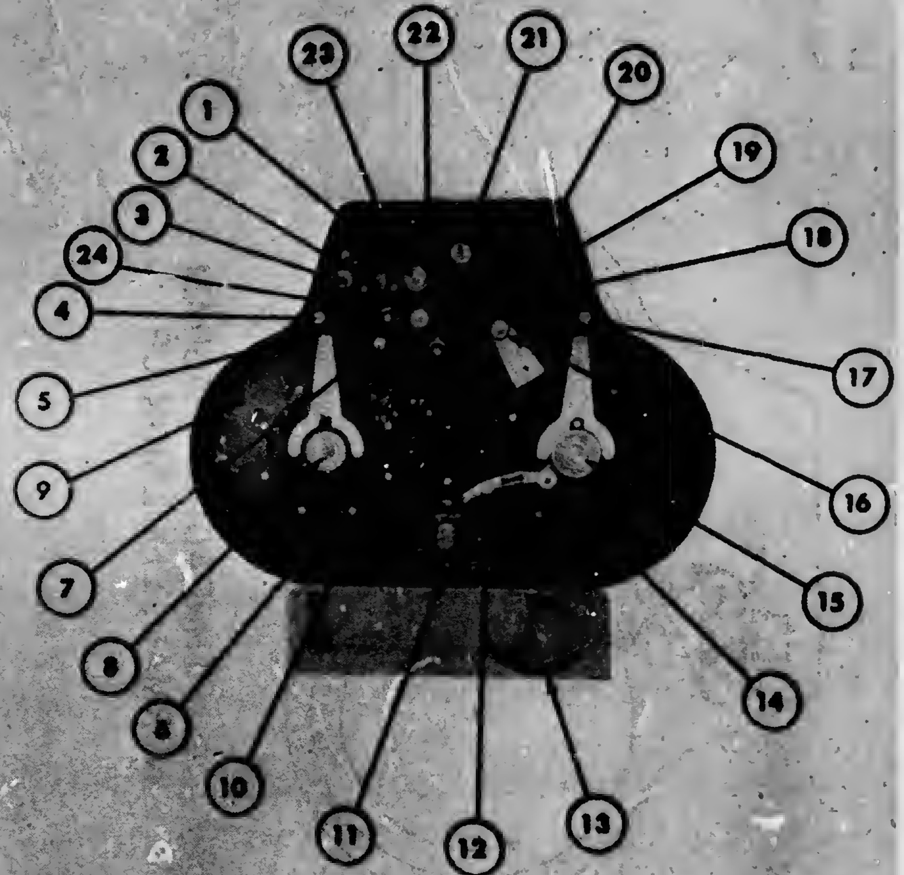


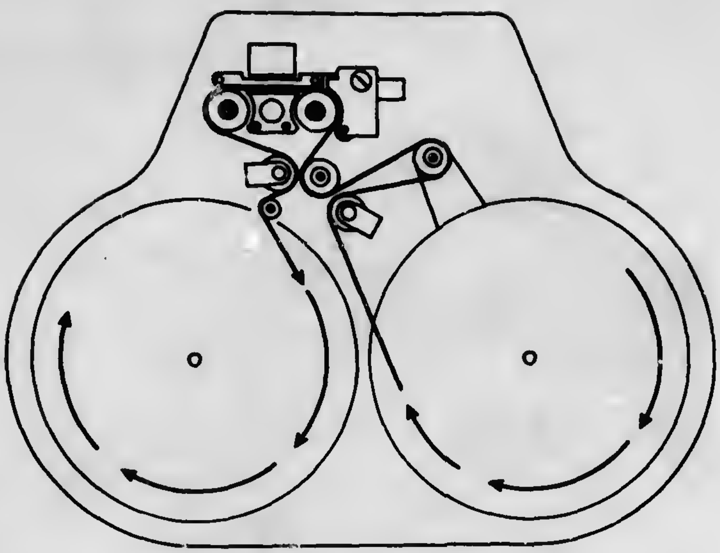
Fig. No. 8--Hycam Camera 400 ft model with door opened and showing film compartment.


HYCAM

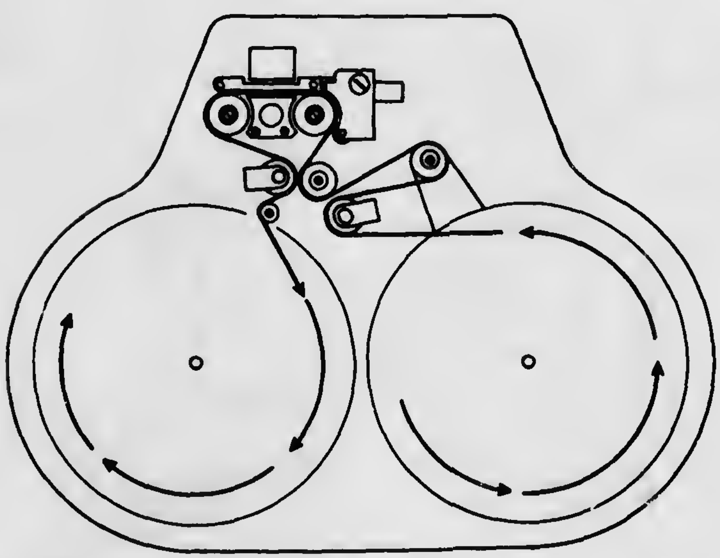


1 FILM SPROCKET
2 LOWER FILM GATE
3 FILM ROLLER
4 TAKEUP EJECTOR BUTTON
5 TAKEUP DAMPING ROLLER
6 100' SPOOL ADAPTER MOUNTING HOLE (3)
7 TAKEUP COMPARTMENT ROLLER
8 TAKEUP SHAFT
9 200' SPOOL ADAPTER MOUNTING HOLE (3)
10 SUPPLY DAMPING ROLLER
11 EVENT SYNC, SCALE AND SETTING KNOB
12 EVENT FOOTAGE FOLLOW ARM ADJUST
13 FOOTAGE INDICATOR
14 EVENT FOOTAGE FOLLOWER
15 SUPPLY SHAFT
16 SERVO BRAKE ARM
17 SUPPLY EJECTOR BUTTON
18 FIRST IDLER ROLLER
19 RED FOCUSING GATE
20 OPTICAL HEAD MOUNTING SCREWS (3)
21 LATCH BLOCK MOUNTING SCREW
22 UPPER FILM GATE
23 'U' PRISM HOUSING
24 CUT OFF SWITCH

Fig. No. 9--Film Compartment and Component Parts of the Camera



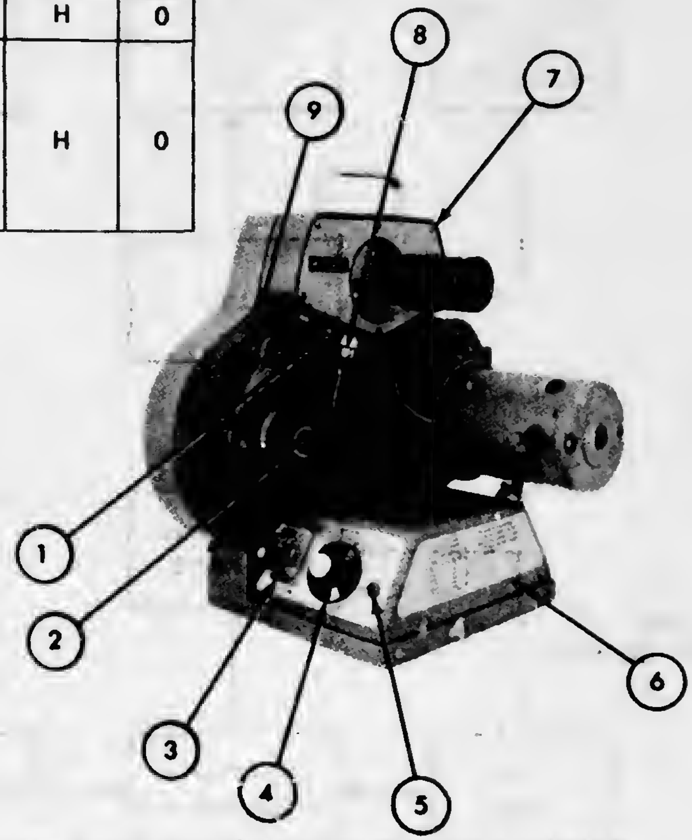
THREADING DIAGRAM
NORMAL, EMULSION UP



THREADING DIAGRAM
EMULSION DOWN

Fig. No. 10--Film Threading Diagrams.

Pictures Per Second Desired (16mm Full Frame Format)	P.P.S. Dial	Multiplier Switch	H-L Speed Reducer	H-L Servo Brake	Drag Brake
20 to 100	20.0 to 99.9	X1	L	L	30
100 to 1,000	10.0 to 99.9	X10	H	L	30
1,000 to 5,000	10.0 to 50.0	X100	H	H	0
6,000 7,000 8,000 9,000 10,000 11,000	18.0 23.0 29.0 37.0 46.0 99.9	High	H	H	0



1 TIMING LIGHT CONNECTORS
2 DRAG BRAKE CONTROL
3 PPS DIAL
4 MULTIPLIER SWITCH
5 STOP/START SWITCH
6 ELECTRONIC CONTROL MODULE
7 OPTICAL HEAD
8 FRAME RATE SENSING CONNECTOR & PLUG
9 SERVO BRAKE CONTROL

Fig. No. 11--External Components of Hycam High-Speed Motion Picture Camera

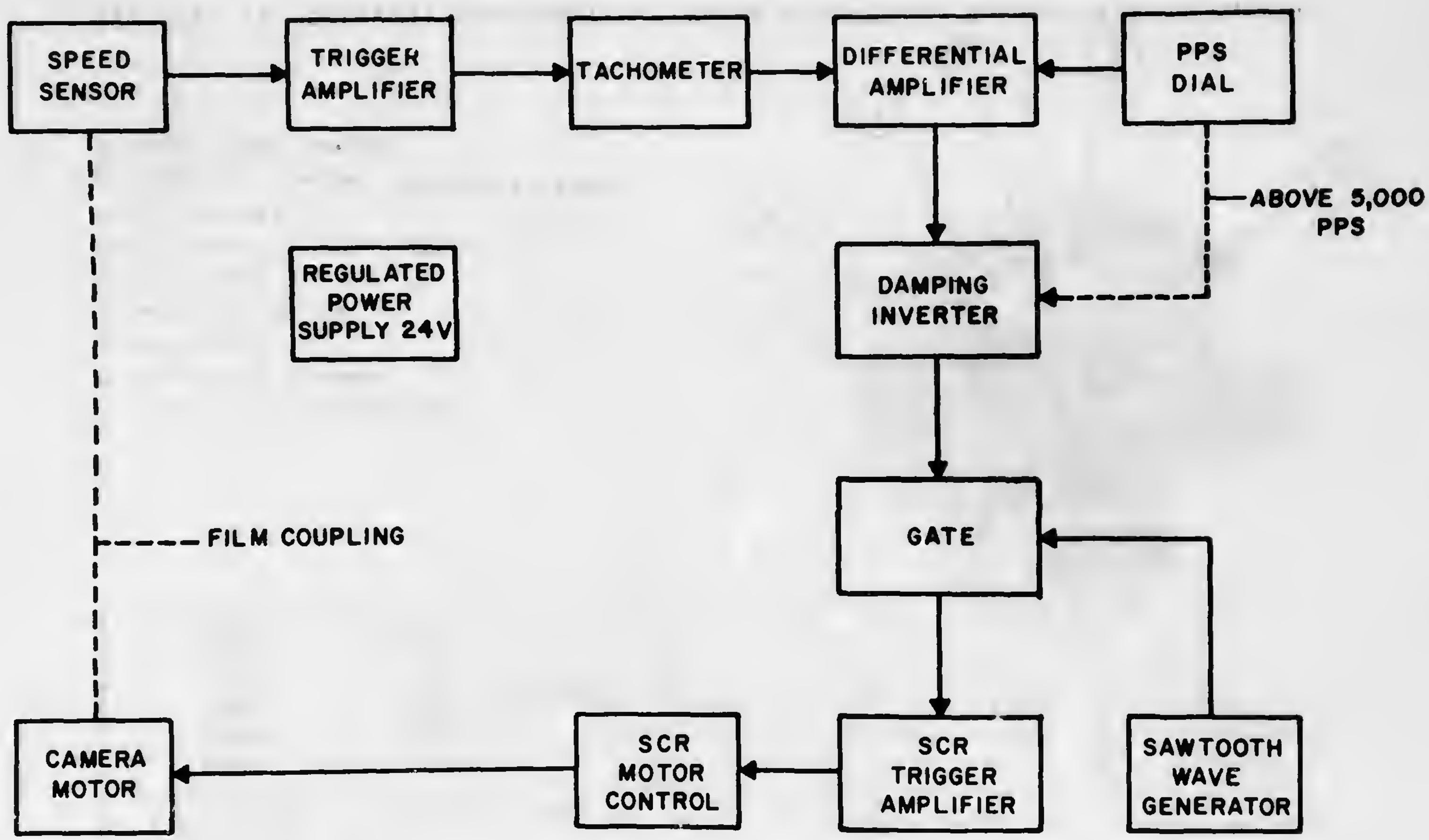


Fig. No. 12--FUNCTIONAL DIAGRAM HYCAM ELECTRONIC SPEED CONTROL

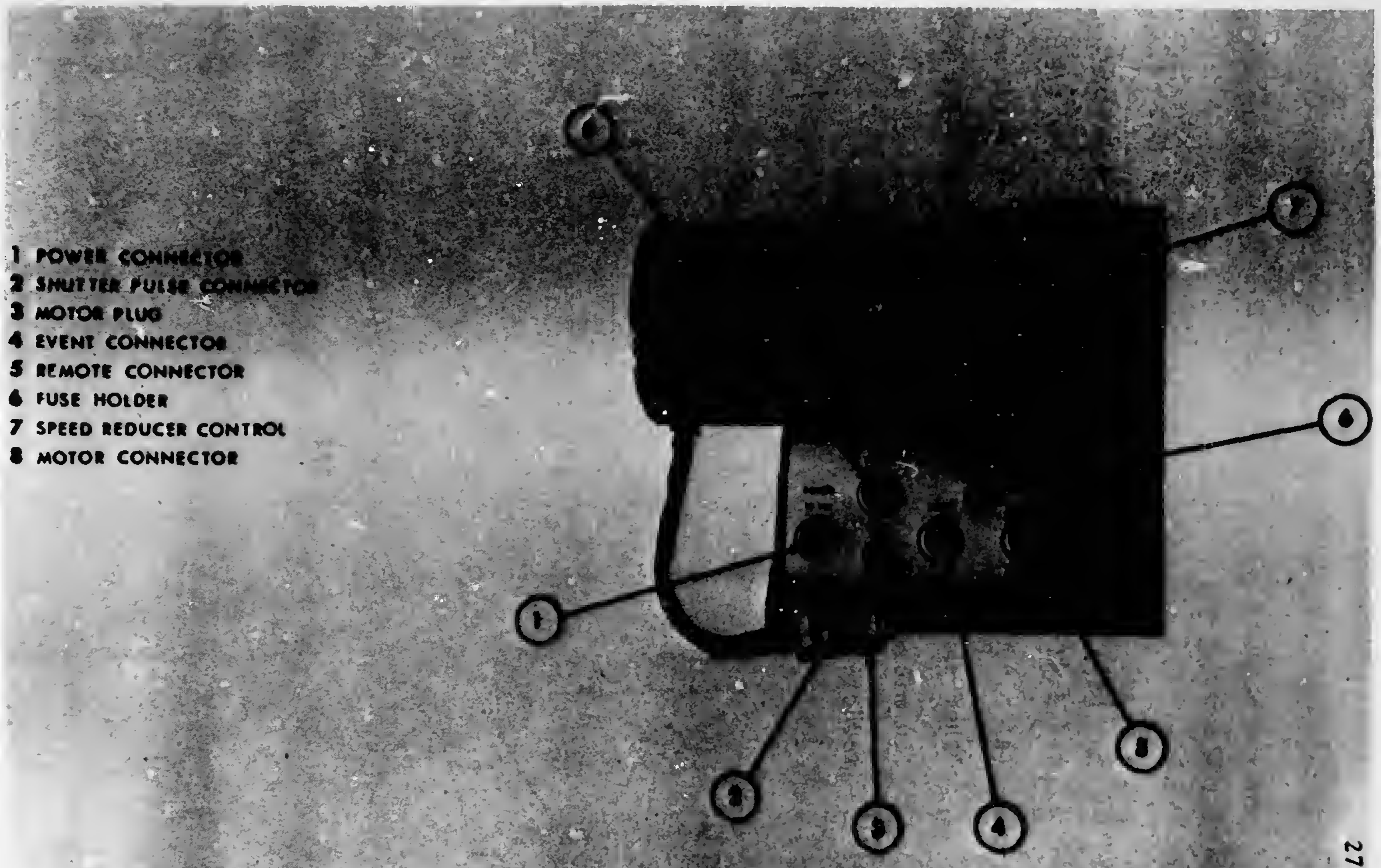
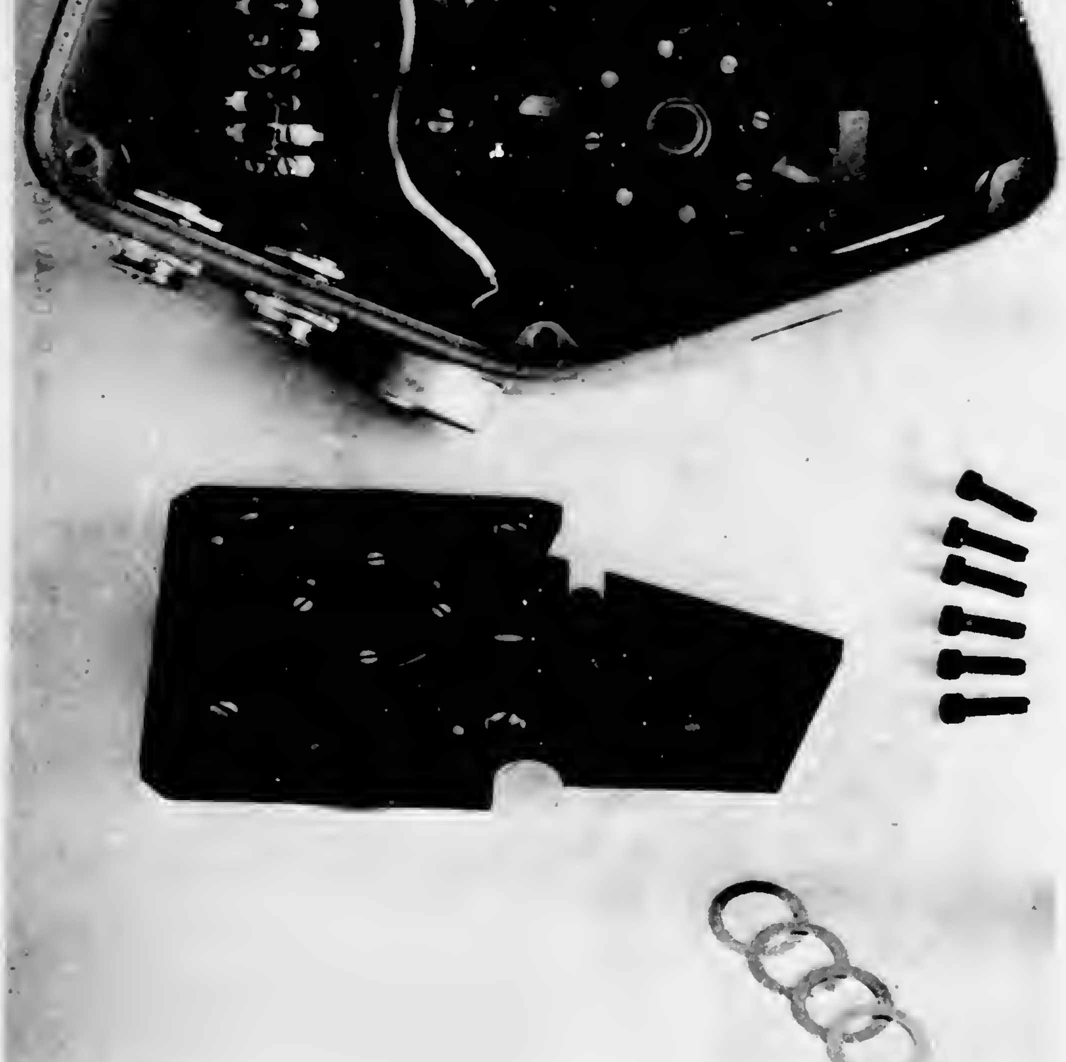


Fig. No. 13--Connectors, Plug, Fuse Holder and Speed Reducer Control

Fig. No. 14--Hycam Camera, Shutter Assembly. Standard shutter gives an exposure ratio of 1/2.5 (at 1,000pps shutter speed is 1/2,500 of a second). Other shutters are available down to 1/100 for a 1.0 microsecond exposure at 10,000 pps without reduction in frame height.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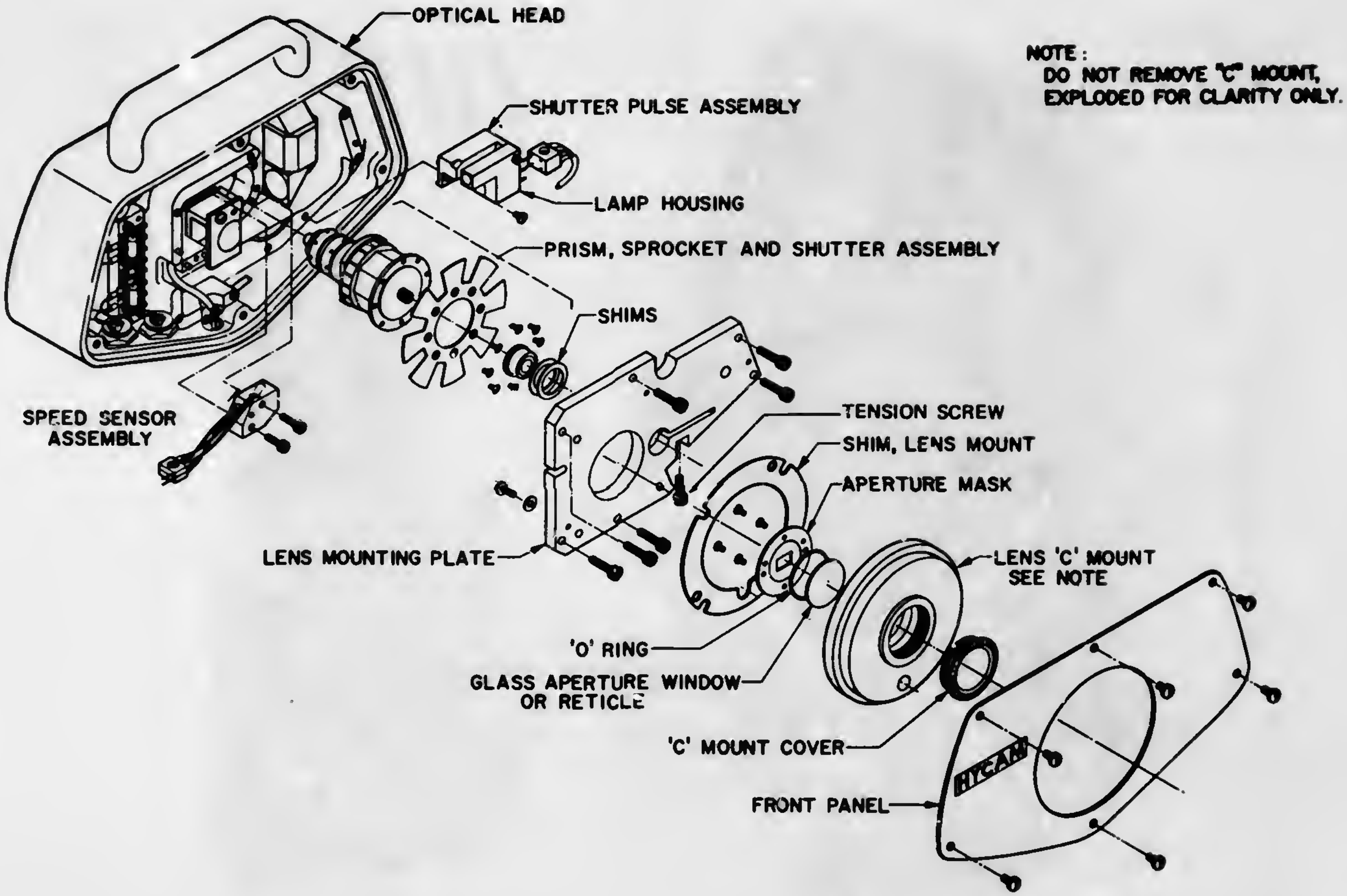

Fig. No. 15-- HYCAM OPTICAL HEAD

AD-A034 497 AIR FORCE FLIGHT TEST CENTER EDWARDS AFB CALIF F/G 14/5
PHOTOGRAPHY IN SCIENTIFIC RESEARCH - SELECTED BIBLIOGRAPHY AND --ETC(U)
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UNCLASSIFIED AFFTC-TIH-76-4 NL

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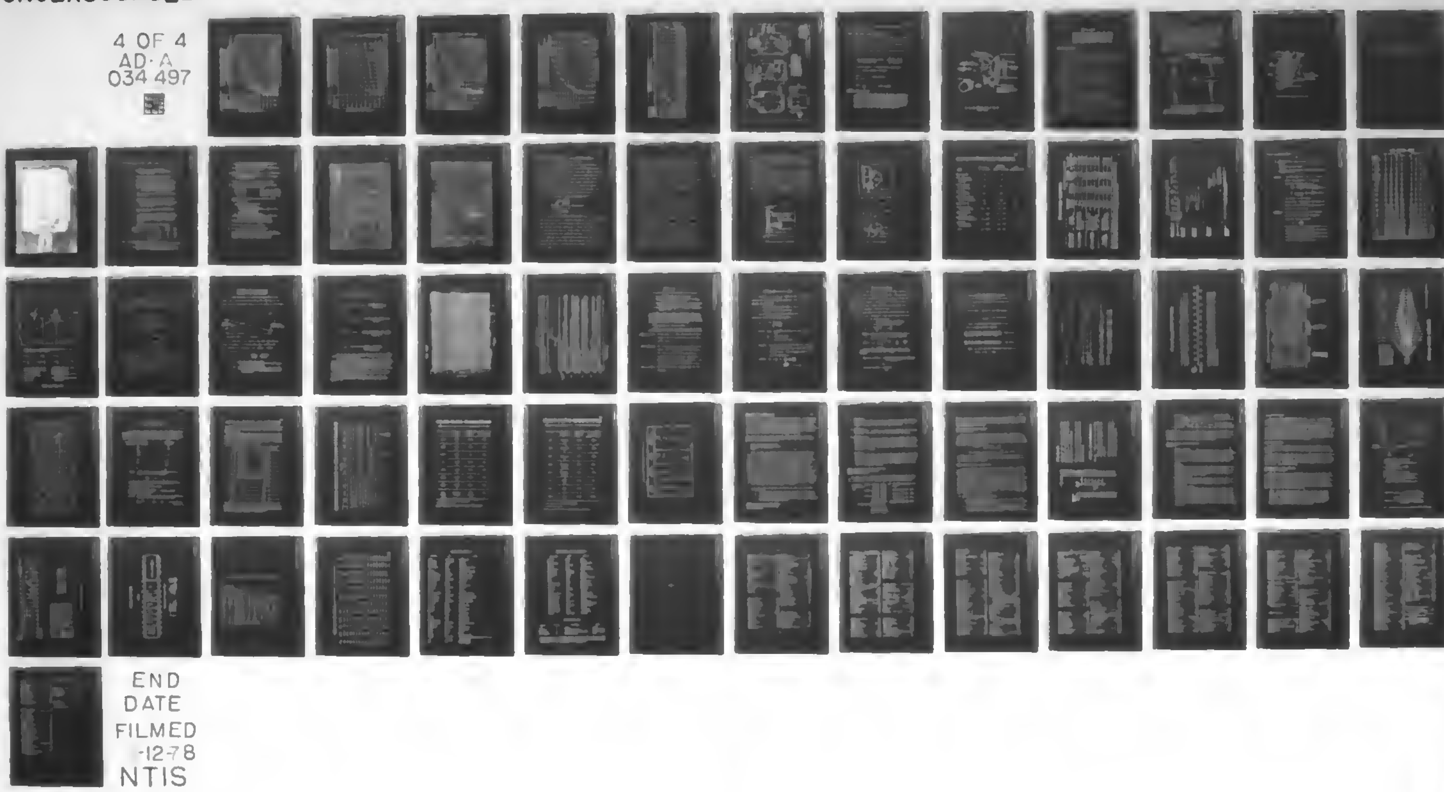

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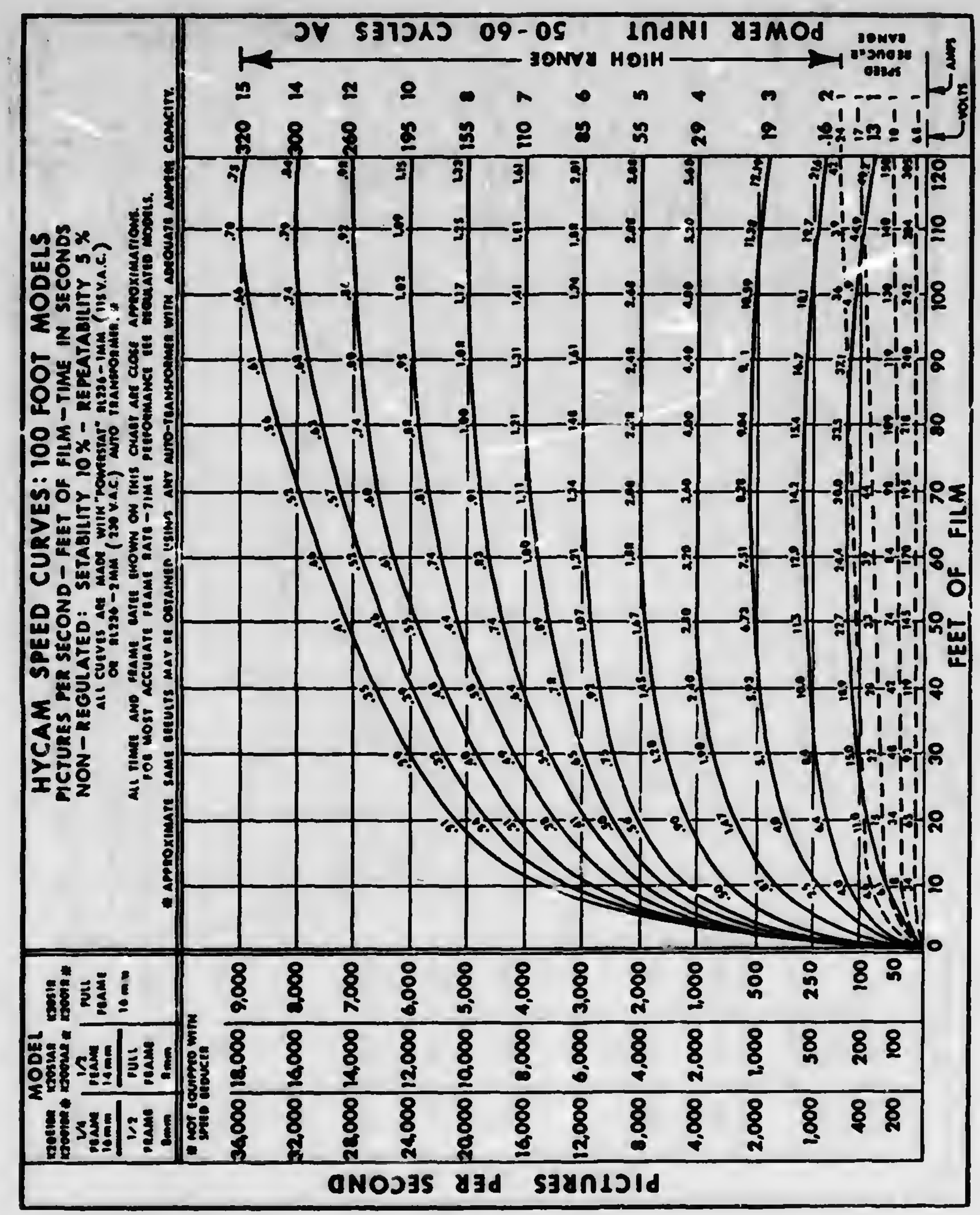
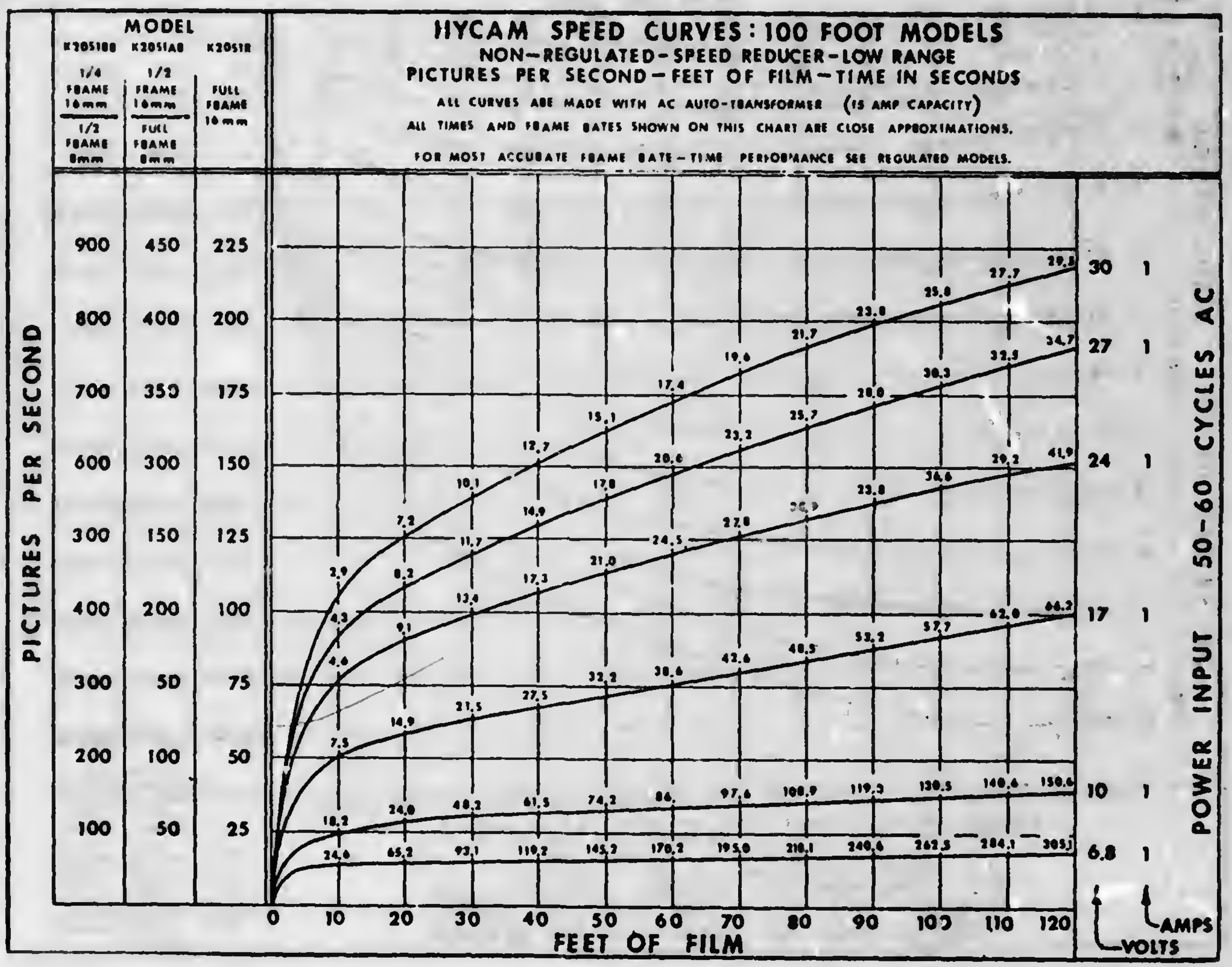
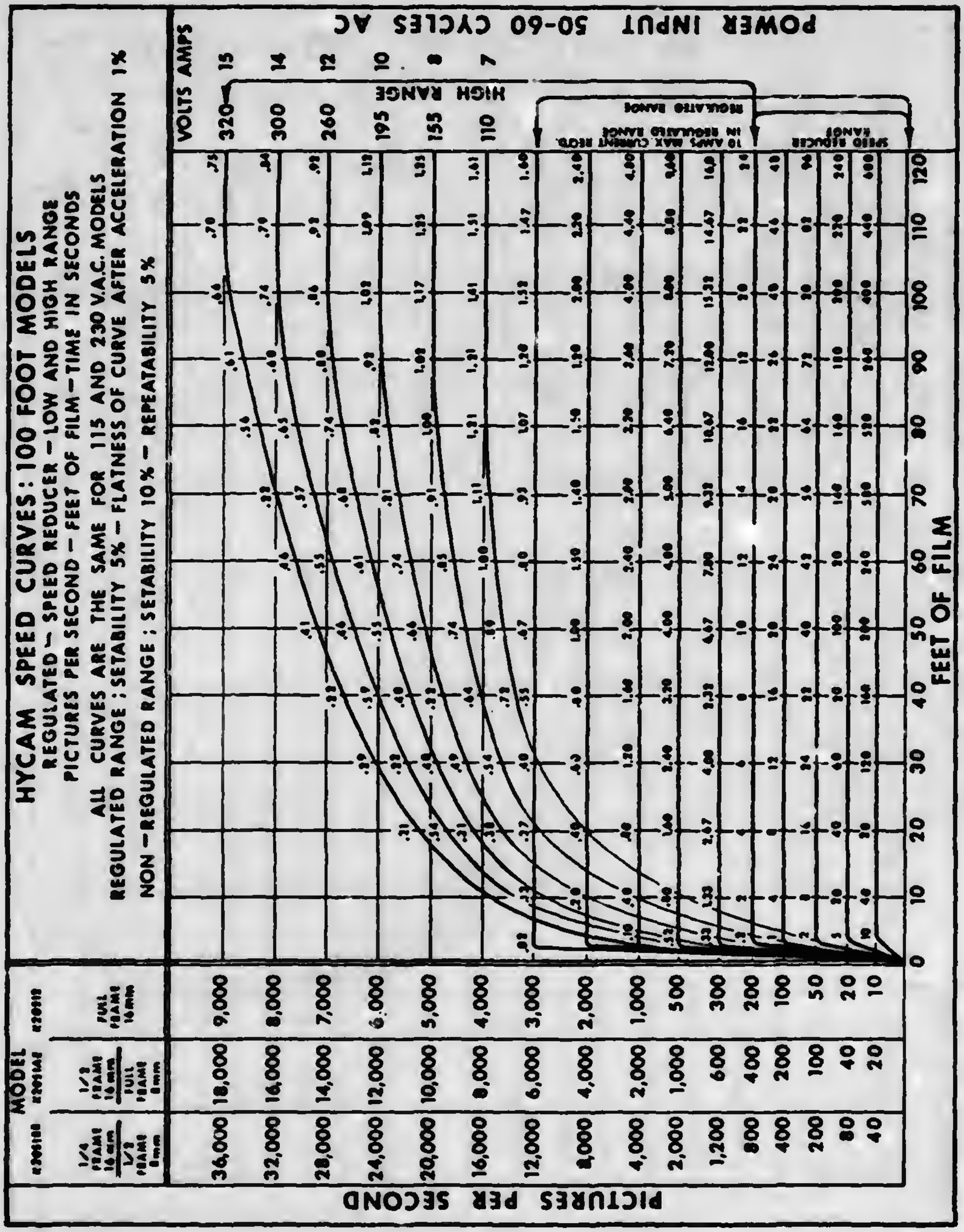
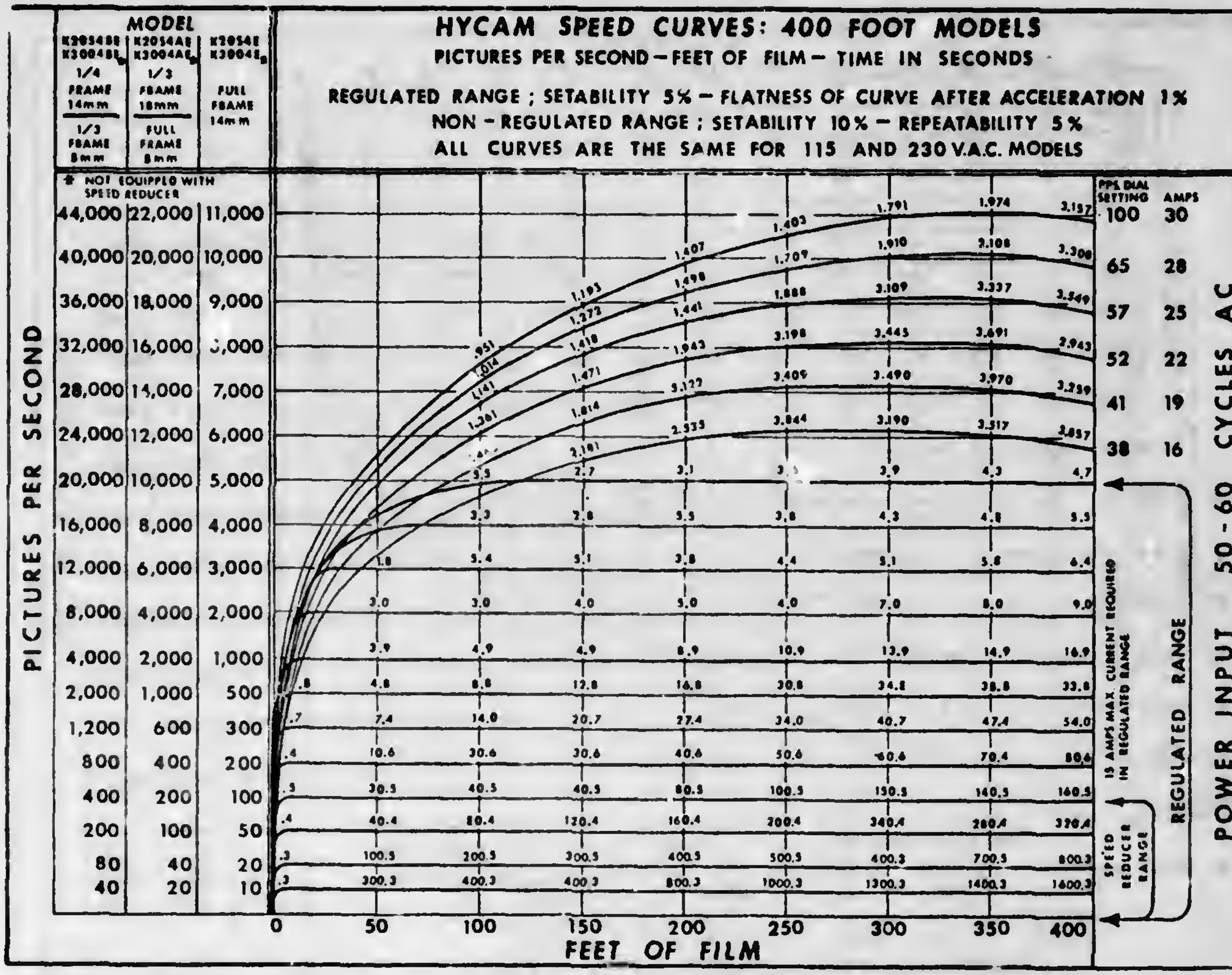
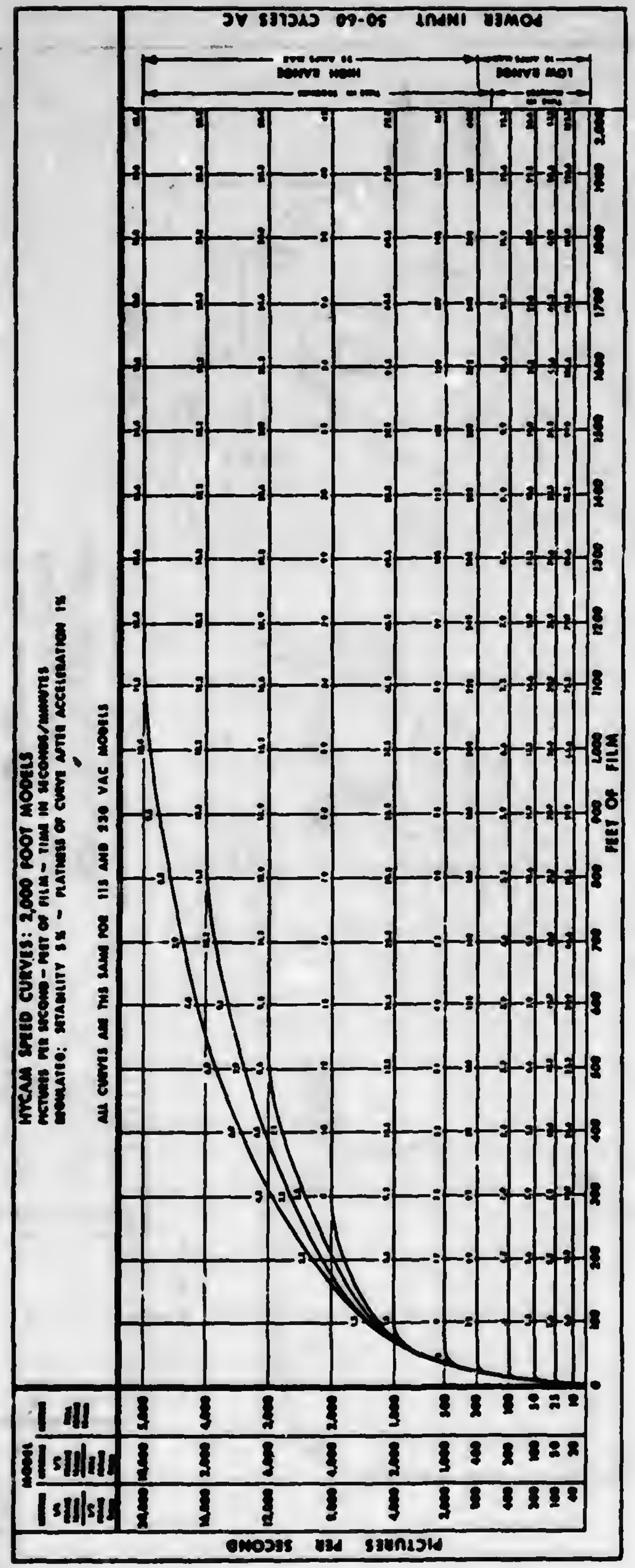

HYCAM SPEED CURVES: 100 FOOT MODELS
PICTURES PER SECOND – FEET OF FILM – TIME IN SECONDS
NON-REGULATED: SETABILITY 10% – REPEATABILITY 5%
POWER INPUT 50-60 CYCLES AC
HIGH RANGE
FEET OF FILM
PICTURES PER SECOND
MODEL

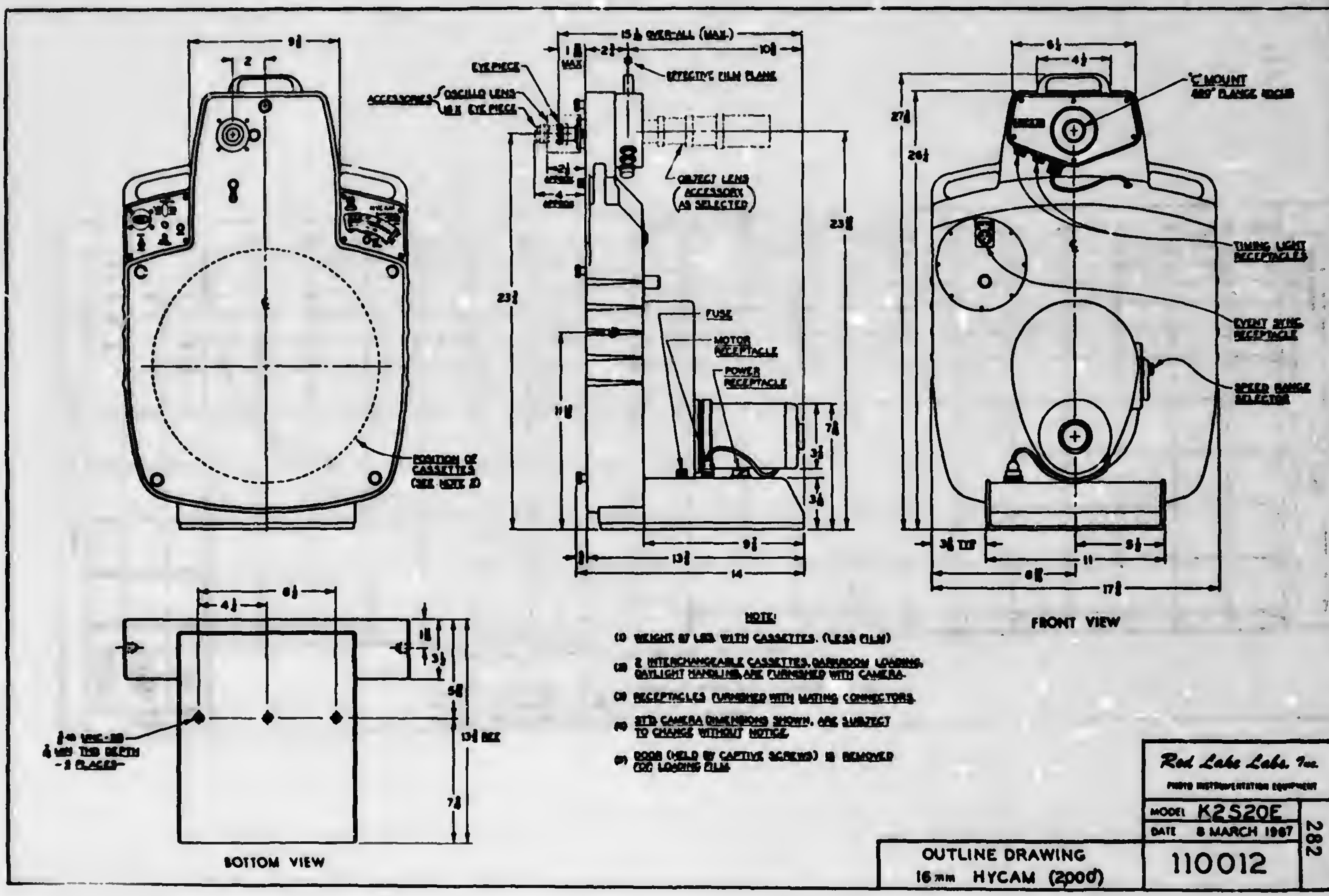

HYCAM SPEED CURVES: 100 FOOT MODELS
NON-REGULATED-SPEED REDUCER-LOW RANGE
PICTURES PER SECOND-FEET OF FILM-TIME IN SECONDS
ALL CURVES ARE MADE WITH AC AUTO-TRANSFORMER (15 AMP CAPACITY)
ALL TIMES AND FRAME RATES SHOWN ON THIS CHART ARE CLOSE APPROXIMATIONS.
FOR MOST ACCURATE FRAME RATE-TIME PERFORMANCE SEE REGULATED MODELS.
MODEL
1/4 FRAME 16mm
1/2 FRAME 8mm
1/2 FRAME 16mm
FULL FRAME 8mm
FULL FRAME 16mm
PICTURES PER SECOND
FEET OF FILM
POWER INPUT 50-60 CYCLES AC
VOLTS
AMPS


HYCAM SPEED CURVES: 100 FOOT MODELS
REGULATED - SPEED REDUCER - LOW AND HIGH RANGE
PICTURES PER SECOND - FEET OF FILM - TIME IN SECONDS
ALL CURVES ARE THE SAME FOR 115 AND 230 V.A.C. MODELS
REGULATED RANGE ; SETABILITY 5% - FLATNESS OF CURVE AFTER ACCELERATION 1%
NON - REGULATED RANGE ; SETABILITY 10% - REPEATABILITY 5%
POWER INPUT 50-60 CYCLES AC
VOLTS AMPS
HIGH RANGE
FEET OF FILM
PICTURES PER SECOND
MODEL



HYCAM SPEED CURVES: 400 FOOT MODELS
PICTURES PER SECOND – FEET OF FILM – TIME IN SECONDS
REGULATED RANGE ; SETABILITY 5% – FLATNESS OF CURVE AFTER ACCELERATION 1%
NON – REGULATED RANGE ; SETABILITY 10% – REPEATABILITY 5%
ALL CURVES ARE THE SAME FOR 115 AND 230 V.A.C. MODELS
MODEL
1/4 FRAME 14mm
1/3 FRAME 8mm
1/3 FRAME 16mm
FULL FRAME 8mm
FULL FRAME 14mm
NOT EQUIPPED WITH SPEED REDUCER
44,000 22,000 11,000
40,000 20,000 10,000
36,000 18,000 9,000
32,000 16,000 8,000
28,000 14,000 7,000
24,000 12,000 6,000
20,000 10,000 5,000
16,000 8,000 4,000
12,000 6,000 3,000
8,000 4,000 2,000
4,000 2,000 1,000
2,000 1,000 500
1,200 600 300
800 400 200
400 200 100
200 100 50
80 40 20
40 20 10
PICTURES PER SECOND
0 50 100 150 200 250 300 350 400
FEET OF FILM
PPS DIAL SETTING
AMPS
100 30
65 28
57 25
52 22
41 19
38 16
15 AMPS MAX. CURRENT REQUIRED IN REGULATED RANGE
SPEED REDUCER RANGE
REGULATED RANGE
POWER INPUT 50-60 CYCLES AC


HYCAM SPEED CURVES: 2,000 FOOT MODELS
ALL CURVES ARE THE SAME FOR 115 AND 230 VAC MODELS
POWER INPUT 50-60 CYCLES AC
HIGH RANGE
LOW RANGE
PICTURES PER SECOND
FEET OF FILM


BOTTOM VIEW
FRONT VIEW
EYE PIECE
ACCESSORIES
OSCILLO LENS
EYE PIECE
EFFECTIVE FILM PLANE
15 OVER-ALL (MAX.)
MAX
OBJECT LENS
ACCESSORY
AS SELECTED
FUSE
MOTOR RECEPTACLE
POWER RECEPTACLE
POSITION OF CASSETTES
(SEE NOTE 2)
"C" MOUNT
FLANGE FOCUS
TIMING LIGHT RECEPTACLES
EVENT SYNC RECEPTACLE
SPEED RANGE SELECTOR
TYP
REF
3 PLACES
NOTE:
(1) WEIGHT LBS. WITH CASSETTES. (LESS FILM)
(2) 2 INTERCHANGEABLE CASSETTES, DARKROOM LOADING, DAYLIGHT HANDLING, ARE FURNISHED WITH CAMERA.
(3) RECEPTACLES FURNISHED WITH MATING CONNECTORS.
(4) STD. CAMERA DIMENSIONS SHOWN, ARE SUBJECT TO CHANGE WITHOUT NOTICE.
(5) DOOR (HELD BY CAPTIVE SCREWS) IS REMOVED FOR LOADING FILM.
Red Lake Labs. Inc.
PHOTO INSTRUMENTATION EQUIPMENT
MODEL K2S20E
DATE 8 MARCH 1967
OUTLINE DRAWING
16mm HYCAM (2000')
110012
282

Instrumentation Cameras with Intermittent Pin-Registered Film Transport Movements.

Locam 16-mm Camera Models 50 and 51.

Shutter Speeds.--The Locam is furnished with a double disc shutter adjustable from 0 to 160 degrees. For precise work below 20 degrees shutter opening it is recommended that a fixed blade shutter be utilized.

To determine shutter speed, the following calculations may be used.

$$\frac{\text{Shutter opening in degrees}}{\text{Frames/second x 360}} = \frac{\text{Shutter Speed}}{\text{in Seconds}}$$

Exposure Ratio x reciprocal of frame rate = Shutter speed in seconds.

$$\frac{120}{200 \times 360} = 1/600 \text{ second or}$$

$$1/3 \times \frac{1}{200} = 1/600 \text{ second.}$$

INTERNAL REFLEX OPTICS

The optional boresighting optics are placed in position by rotating the view knob clockwise as indicated by the arrow on the knob. This places the lower 90° prism in position on the optical axis to direct the lens image to the ground glass just above it. The upper surface of the ground glass optic acts as a field lens. The upper 90° prism reflects an inverted image to the optional Model 50-0743 boresight tool for viewing and focusing with the film in the camera. See Figure 16

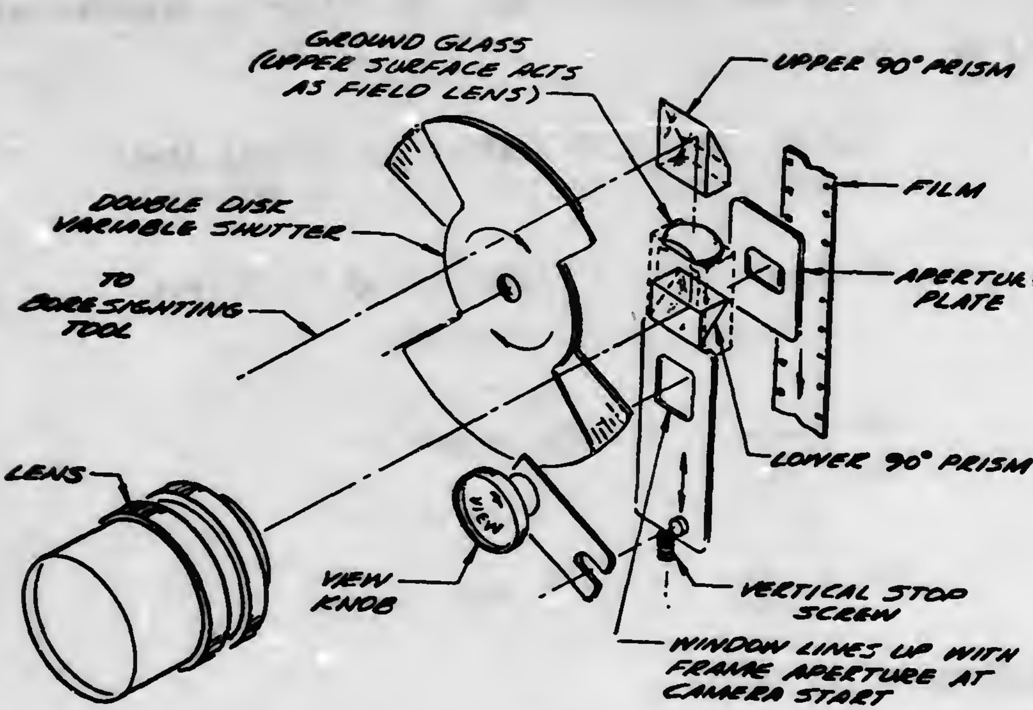


Fig. No. 16--INTERNAL REFLEX OPTICS
LOCAM CAMERA

CAUTION

Do not attempt to rotate the view knob counter-clockwise to retract the internal reflex optics, as this will result in damage to the mechanism. The system is designed to automatically release when camera starts. Manual release may be accomplished by rotating the film advance knob.

COAXIAL FILM FEED

Compactness is achieved in the camera by utilizing the advantages of a coaxial film supply. Following the film path as shown in Figure No. 17, illustrates how the film is routed from the supply spool, through the film gate, and on to the take-up spool.

After leaving the supply spool, the film first comes in contact with the servo brake roller. This roller is mechanically connected to the servo brake on the supply spool. When there is slack in the film, the servo roller tension actuates the servo brake to slow the supply spool and prevent film override.

After leaving the servo roller, the film then passes below the auxiliary idler and then over the supply idler. The film is now in position to engage the inner supply sprocket. The teeth of the inner supply sprocket engages the film and routes the film to the outer supply sprocket. An approximate 1" loop (10 perforations) at this point keeps the film moving smoothly from inner to outer supply sprockets.

The film now passes around the outer supply sprocket, and approximately 1/2" loop (5 perforations) is formed. The film then passes through the film gate and an approximate 1/2" loop (5 perforations) is formed prior to passing around the take-up sprocket and take-up idler to the take-up spool.

An end-of-film cutoff switch is located between the take-up sprocket and the take-up idler. This switch is held closed by the film and opens as the end of the film passes through.

- -

HYCAM--LOCAM CAMERAS--SHUTTER DATA

HYCAM

EXPOSURE RATIO	SINGLE-SLOT OPENING EQUIVALENT IN DEGREES
1/2.5	144
1/5	72
1/10	36
1/20	18
1/50	7.5
1/100	3.6

LOCAM

EXPOSURE RATIO	SINGLE-SLOT OPENING EQUIVALENT IN DEGREES
1/2	180
1/2.25	160
1/3	120
1/4.5	80
1/6	60
1/9	40
1/12	30
1/18	20
1/24	15
1/36	10
1/48	7.5
1/72	5

Note: Locam is furnished iwth a double disc variable shutter adjustable from 0 - 160 degrees. For precise work below 20 degrees shutter opening, it is recommended that a fixed blade shutter be utilized.

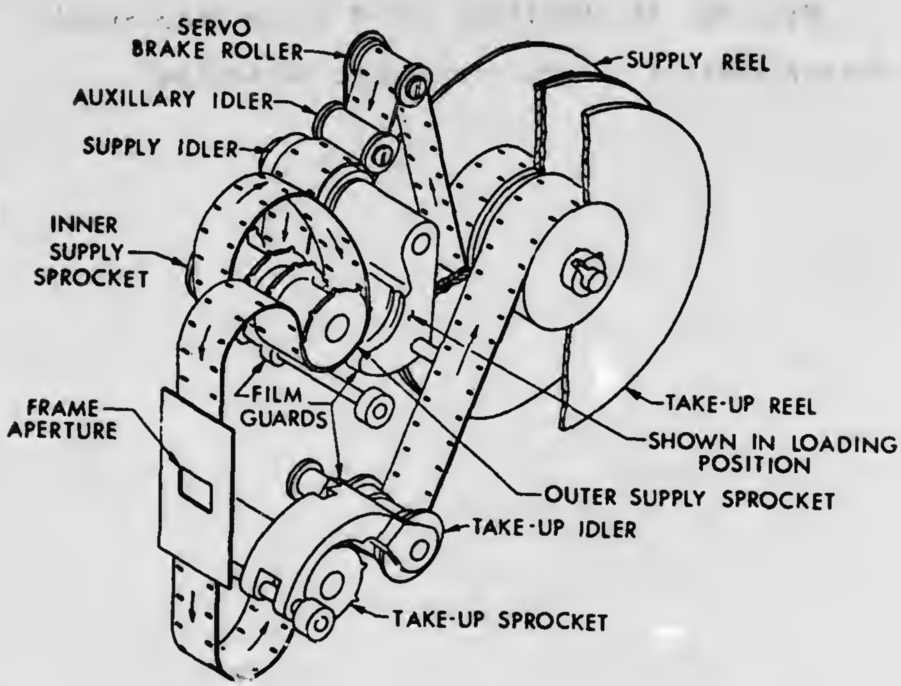
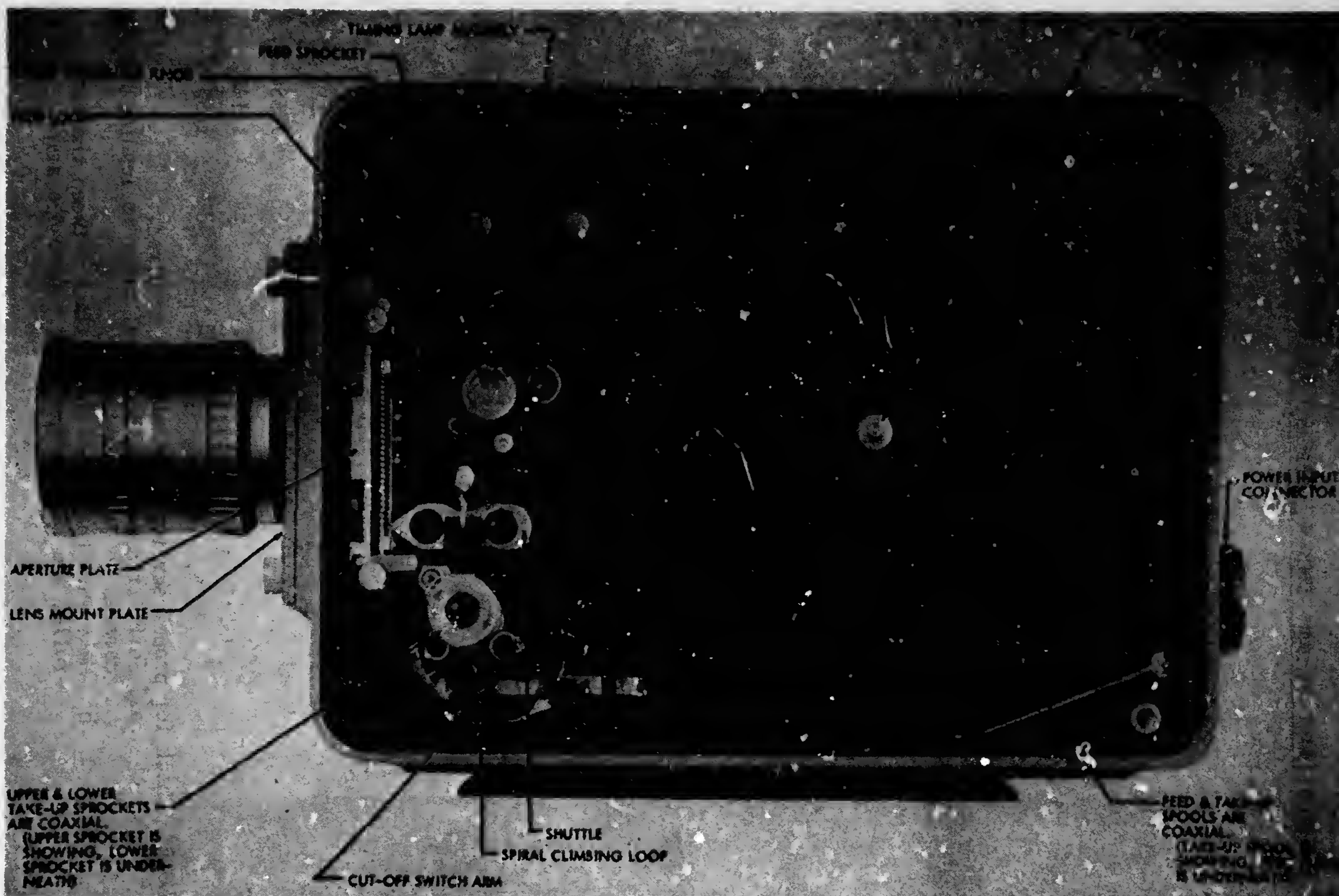


Fig. No. 17--Locam Camera--Coaxial Film Feed

Fig. No. 18--Milliken DBM-4 16-mm High-Speed Motion Picture Camera--Transport Mechanism.


TIMING LAMP
FEED SPROCKET
POWER INPUT CONNECTOR
APERTURE PLATE
LENS MOUNT PLATE
UPPER & LOWER TAKE-UP SPROCKETS ARE COAXIAL. (UPPER SPROCKET IS SHOWING, LOWER SPROCKET IS UNDERNEATH)
CUT-OFF SWITCH ARM
SHUTTLE
SPIRAL CLIMBING LOOP
FEED & TAKE-UP SPOOLS ARE COAXIAL.

DB-Milliken 16-mm DMB-4, DBM-5, DBM-44, DBM-54.

Check List:

1. Check and clean camera equipment.
   a. Clean gate with orange stick, do not use metallic objects.

2. Obtain all power cords and timing cables.

3. Check that pull down claw and register pin enter sprocket holes properly, that they are not bent, and aperture plate is free of film chips and emulsion buildup.
   Note: Intermittent motion with register pin locks film stationary during exposure. Mechanism is dynamically balanced.

4. Make lower front loop as outlined by the mark in the camera.

5. Load camera (If pressure plate was removed to load--replace).
   a. With cover off, turn film thru by hand using knob on back side of camera to ascertain proper operation.

6. Check that film edge presses against side of micro-switch arm.

7. If film breaks or jams check loading procedure.
   Note: 16-mm ASA Standard Perf 2 sides, camera is adjusted to high-speed perf (0.3000 pitch) can be adjusted for short pitch (0.2994) if required.

MILLIKEN DBM-5a W/VARIABLE SPEED SHIFT

Shift Knob Position	Fast FPS	Exp SEC	Slow FPS	Exp SEC
1	400	1/900	250	1/550
2	100	1/225	64	1/140
3	40	1/90	24	1/50

NOTE: Check for proper shutter and change as required.
   a. Shift transmission to neutral prior to loading DMB 5a cameras so equipped.
   b. Make sure that there is no slack between the last roller and take-up spool for proper operation.

c. NEW TRANSISTORIZED CAMERAS ARE POLARITY CONSCIOUS--CHECK POLARITY PRIOR TO DC OPERATION.

d. DBM-54 -- 400 ft load--Multiple turn counter selects any film speed from 2 to 400 fps.

8. DBM-54 has a 2-second delay when you activate camera and when the camera operates.
   a. Heavy duty micro-switch automatically stops camera at end of the film run.

9. Timing Lights--NE-2J High-Brightness Neon Lamps.

10. DBM Type Camera Lubrication: Use Windsor Oil L-245X, one small drop only; remove excess oil.

400 - 500 fps	Each 1200 to 1500 ft.
128 - 200 fps	Each 3000 to 6000 ft.
48 - 64 fps	Each 7000 to 9000 ft.
4 - 32 fps	Each 10000 to 15000 ft.

Lubrication at regular intervals, 3,000 to 6,000 ft--ONE DROP OF OIL TO:

a. Register pin linkage point.
b. Register pin pivots.
c. Register pin lever pivots.
d. Both edges of slide block when it makes contact with pilot pin lever.
e. All accessible bearings.
f. Remove excess grease and oil.

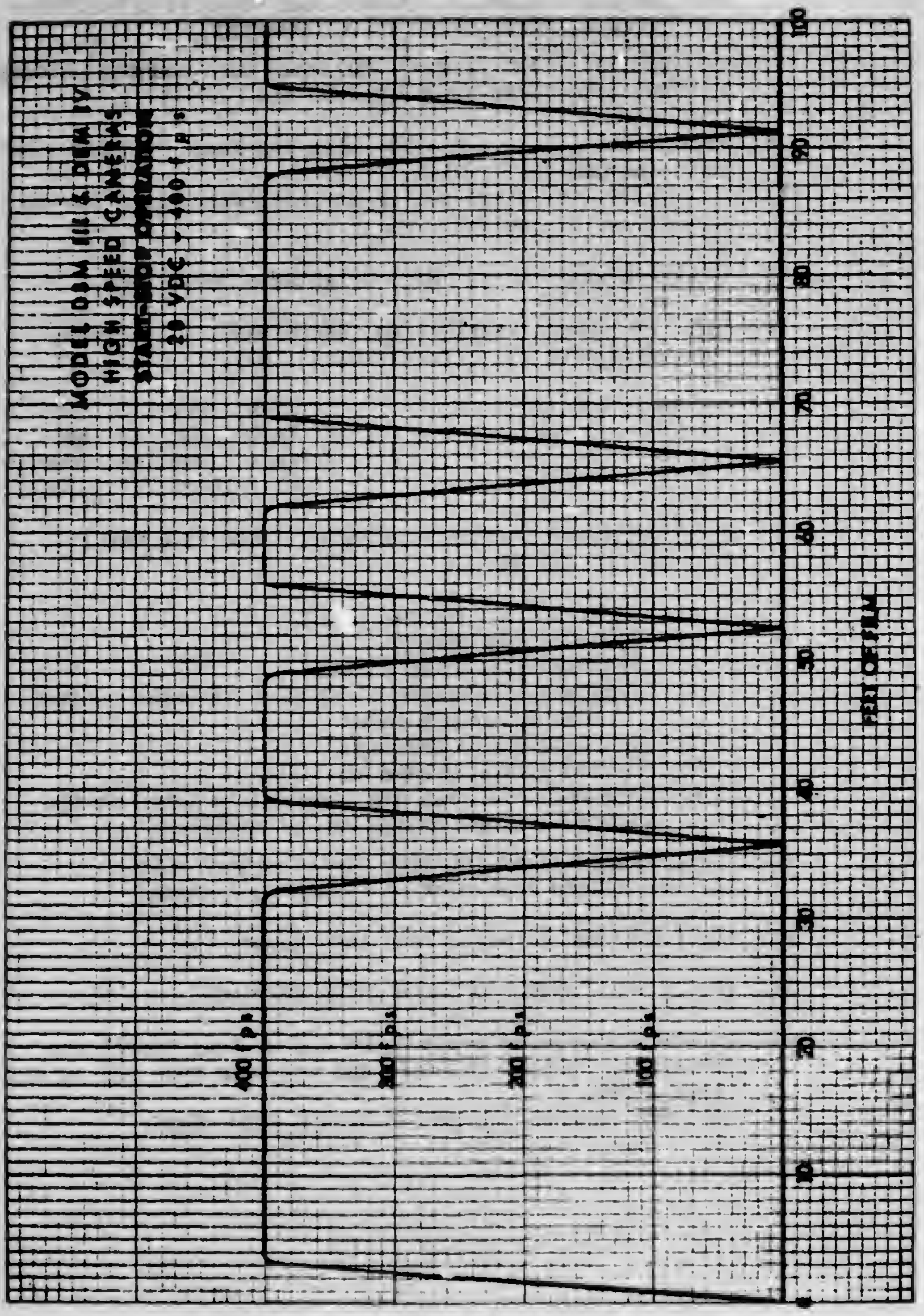
NOTE: Late model cameras are permanently lubed at the Factory. Older Models can be modified.

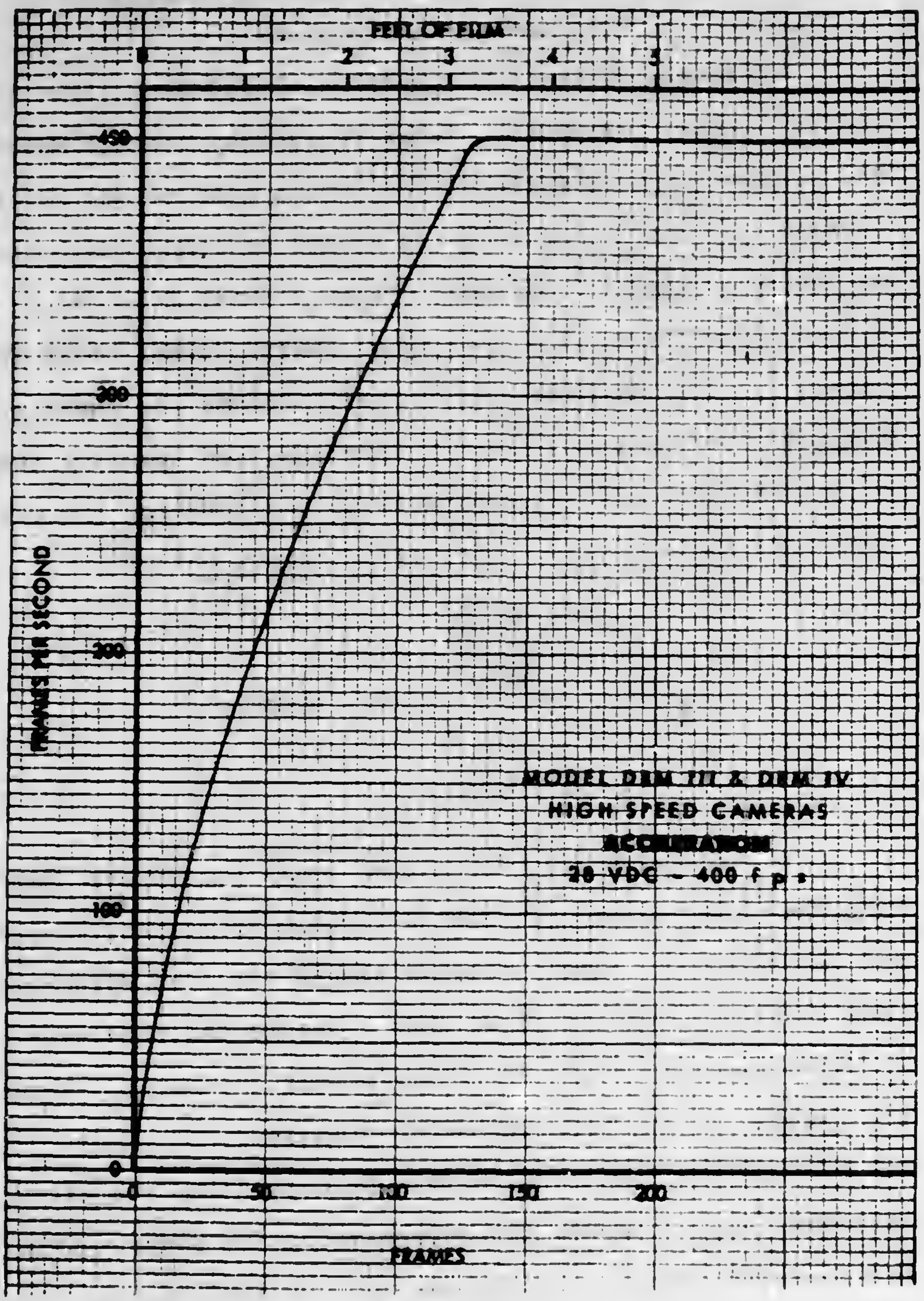
11. Clean and/or clear register pin clearance hole.
    a. Use a wood toothpick or orange wood stick.

12. Use care when screwing lens into mount.

13. DO NOT OIL SHUTTLE OR FILM GUIDE BEARINGS.

14. To lubricate gears (Main Drive and Helical Gears) use lubriplate 930A on helicals and molykote type BR2 on all other gears.
    CAUTION: REMOVE ALL EXCESS GREASE FROM GEARS.

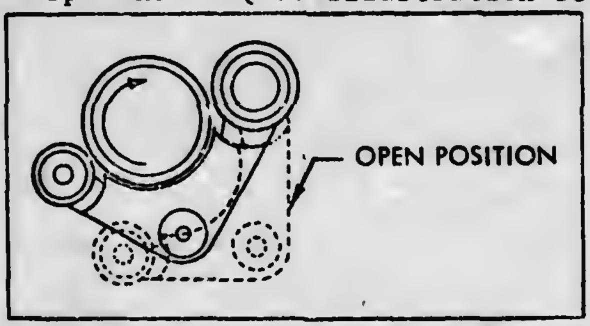

MODEL DBM III & DBM IV
HIGH SPEED CAMERAS
28 VDC - 400 f.p.s
400 f.p.s
300 f.p.s
200 f.p.s
100 f.p.s
0
10
20
30
40
50
60
70
80
90
100
FEET OF FILM


FEET OF FILM
0
1
2
3
4
5
FRAMES PER SECOND
0
100
200
300
400
MODEL DBM III & DBM IV
HIGH SPEED CAMERAS
28 VDC - 400 f p s
0
50
100
150
200
FRAMES

Milliken High-Speed Cameras [Teledyne Camera Systems]

Loading Instructions

Transmission-equipped cameras should be shifted to neutral prior to loading. After retracting footage counter and loading film on feed spindle--spool must rotate clockwise as film is drawn from it (Film should be wound "Emulsion-in" on the feed spool). Release footage counter tab. Place red spindle (Take up) on the spool shaft. Unreel about 18 inches of film from the supply reel. Rotate the shuttle to its fully retracted position. Open the feed sprocket guide by pulling the feed guide plunger up and rotating the guide away from the sprocket. (See illustration below).



Thread film clockwise around brake roller arm (DBM-5 only) Wrap the film counter -clockwise between the timing lamp housing and guide roller, then clockwise around the feed sprocket. Snap the feet sprocket guide shut. Rotate the threading knob at least two full turns to verify proper threading. Return the shuttle to its FULL RETRACTED position.

Open the film tension rail by depressing the extended rail arms fully towards the camera mechanism plate. Lock the tension rail open by sliding the rail assembly toward the top of the camera.

Form the counter-clockwise feed loop to size slightly larger than the white line on the pin driver cover. Insert the film between the two guide posts and into the gate. Because the register pin is in the film plane when the shuttle is fully retracted, the film will be prevented from seating properly in the gate at this time. Press on the rear of the shuttle to rotate it counter-clockwise until the shuttle tips just touch the film. At this position the register pin is retracted and the film can be seated in the gate.

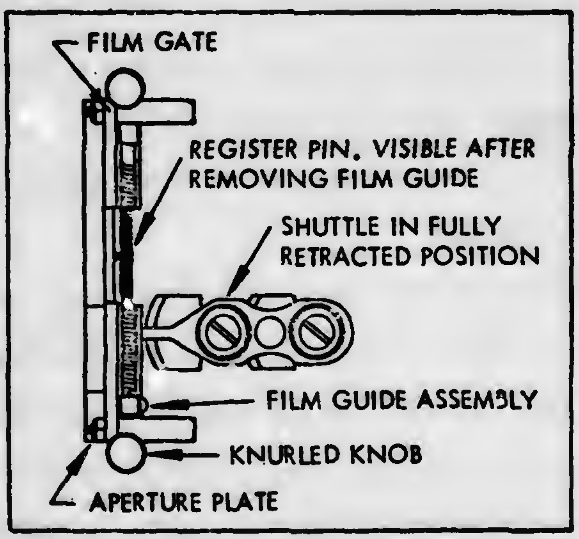
CAUTION: Too much pressure can dimple or punch the film causing it to bind in the gate.

Press on the edge of the film at both sides of the gate and slide film slightly forward and backward to seat properly in the film plane. Unlock tension rail and allow to rest on the edge of the film. Slowly pull free end of film until correct loop size is reached --film perforations should line up with shuttle tips and shuttle should advance into the film perforations. Rotate threading knob several times to verify proper operation.

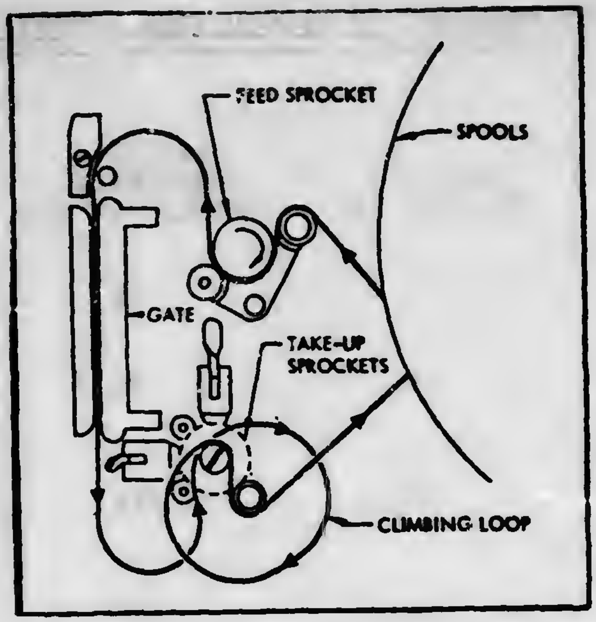
Leave shuttle fully engaged--open lower take-up guide, open upper take-up guide--slip film in to the lower take-up sprocket position, cut-off switch arm will be depressed at this time. Snap lower guide shut. Check lower loop--loop size is equal to the white line--the film is holding the limit switch arm down--the sprocket is properly engaged in the perforations. Form film in a clockwise spiral climbing loop

through upper take-up sprocket and guide--size of loop should correspond to white line. Snap guide shut. Pass the film, counter-clockwise around the last roller (and clutch roller on DBM-5).

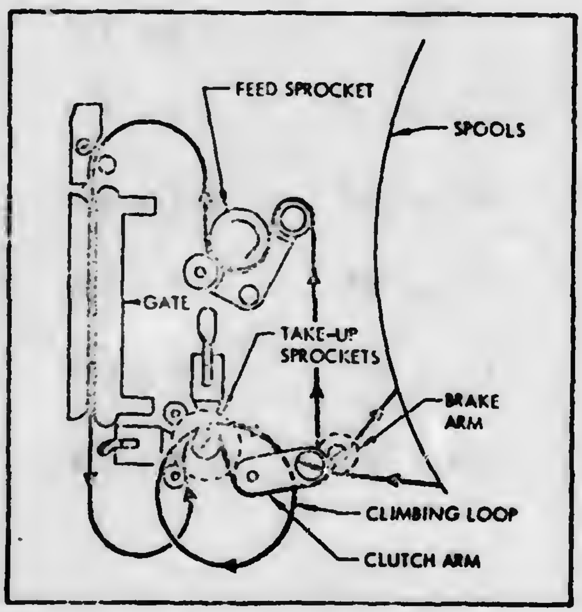
Rotate threading knob several times. Wind film emulsion on take-up spool--so that clockwise rotation of spool will take up film. Engage spool on square shaft of red take-up spindle. Remove bulk of slack--by holding threading knob secure and rotating the take-up spool clockwise. Remove remaining slack by rotating the threading knob clockwise. Note: No slack should be visible between the last roller and the take-up spool.



Film Gate and Shuttle Assembly



DBM-3 and DBM-4 Loading Diagram



DBM-5 Loading Diagram

PICTURE FREQUENCIES REQUIRED TO RECORD SOME COMMON EVENTS

EVENT	VELOCITY FT. PER SEC	PICTURE FREQUENCY FRAMES PER SEC.	TIME MAGNIFICATION
MAN WALKING	3	16	1
TYPE-HAMMER IN AN ACCOUNTING MACHINE	16	96	6
RECOIL OF AN AUTOMATIC MACHINE GUN	40	215	13
AUTOMOBILE CRASH STUDY	100	530	33
PERIPHERAL SPEED OF A CIRCULAR SAW CUTTING WOOD	150	800	50
SOUND IN AIR	10^3	5.3×10^3	330
22 CAL. HIGH VELOCITY BULLET	2.6×10^3	1.4×10^4	860
CRACK FORMING IN GLASS	5×10^3	2.7×10^4	1.7×10^3
DETONATION FRONT FROM AN EXPLSOION	2.5×10^4	1.3×10^5	8×10^3
ELECTRON ACCELERATED THROUGH 900 V	3×10^7	1.6×10^8	10^7
LIGHT	9.8×10^8	5.2×10^9	3.3×10^8

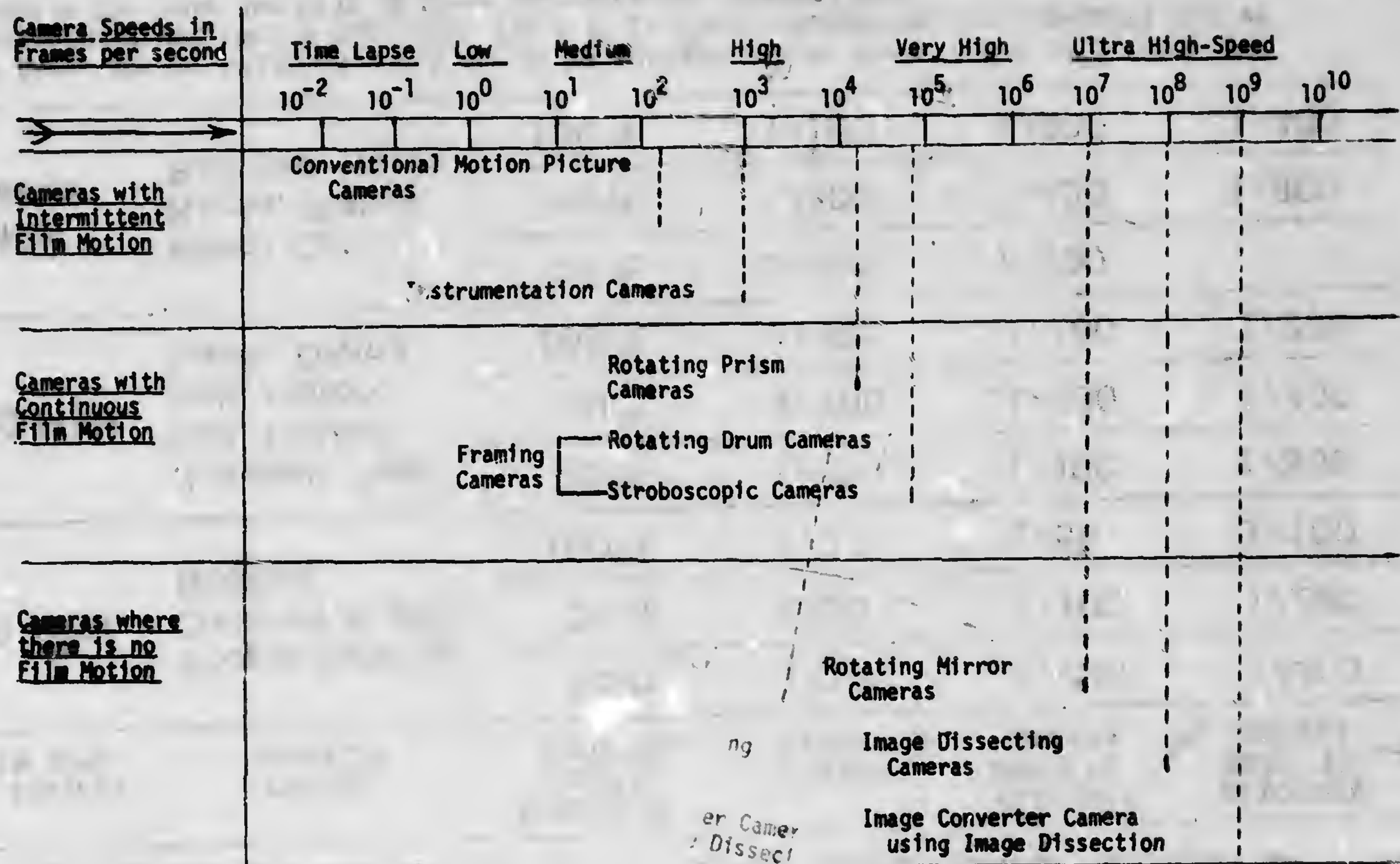
STOPPING MOTION

DIRECTION OF MOTION →

APPROX. SUBJECT SPEED IN MPH	TYPICAL SUBJECTS	CAMERA-TO-SUBJECT DISTANCE	TOWARD CAMERA ↓	45-DEGREE ANGLE TO CAMERA ↘	90-DEGREE ANGLE TO CAMERA →
5 to 10 MPH	People walking, Children at play, Boating	25 ft	1/100	1/200	1/400
		50 ft	1/50	1/100	1/200
		100 ft	1/25	1/50	1/100
25 to 30 MPH	Baseball, Foot-ball, Basket-ball, Motor-boats, Diving	25 ft	1/200	1/400	1/800
		50 ft	1/100	1/200	1/400
		100 ft	1/50	1/100	1/200
60 MPH and faster	Motor Car Races, Planes, Railroad Trains	25 ft	1/400	1/800	. . . . .
		50 ft	1/200	1/400	1/800
		100 ft	1/100	1/200	1/400

The above times are for negatives which are to be enlarged for no more than 4 or 5 times. For greater enlargement use shorter exposures. For 8 to 10 times enlargement use exposures half as long as those in the table; for 16 to 20 times exposures one fourth as long.

SPFED RANGES OF THE BASIC CAMERA TYPES



PHOTOGRAPHY IN SCIENTIFIC RESEARCH

VERTICAL DOTTED LINES INDICATE "Maximum" SPEEDS FOR EACH CAMERA TYPE
(THIS IS SUBJECT TO CHANGE)

Simple Time Lapse Formula

$$I = \frac{E}{F}$$

I = Interval between frames in minutes or fractions of a minute.

E = The event duration in minutes.

F = The number of frames required (projection rate x scene length in seconds).

EXAMPLE: A process requires 8 hours to complete.

Screen time required is 30 seconds.

Determine framing interval:

$$I = \frac{480}{720} \quad \begin{matrix}\text{(8 hours in minutes)} \\ \text{(Frames in 30 seconds) at 24 fps.}\end{matrix}$$

$$I = \frac{2}{3} \quad \text{(Interval time between frames in minutes)}$$

2/3 minute is 40 seconds.

By shooting 1 frame every 40 seconds an 8 hour event will be compressed into 30 seconds of screen time.

EXAMPLE: Process requires 12 hours to complete.

Screen time required is 12 seconds.

Find the Framing Interval.

$$I = \frac{E}{F} = \frac{720}{360} = 2$$

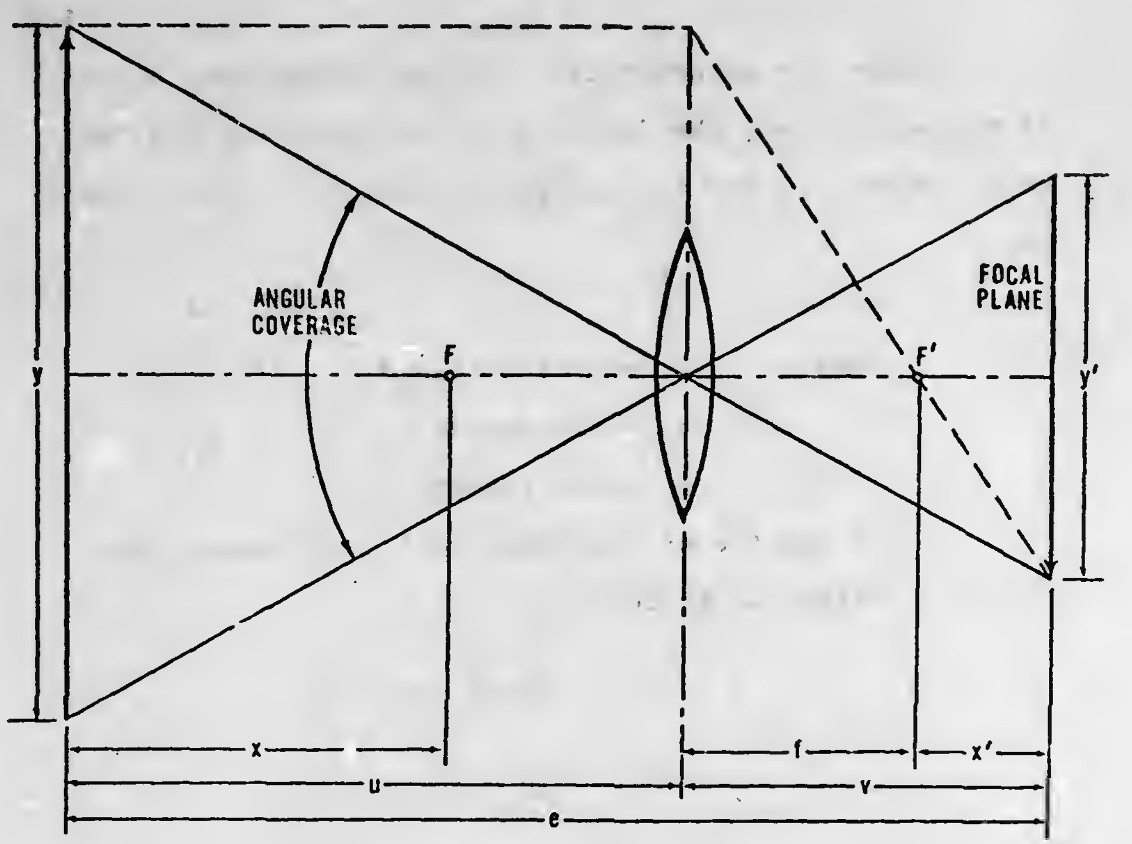
By shooting 1 frame every 2 minutes a 12 hour event will be compressed into 12 seconds of screen time. (Note: For projection rates other then 24 fps, multiply by the desired frame rate instead of 24 fps).

TIME INTERVAL CHART

Action Time (In hours and minutes)

Timer Interval	Projection time at silent speed (18 FPS) 10 Sec.	20 Sec.	30 Sec.	1 Minute	Projection time at sound speed (24 FPS) 10 Sec.	20 Sec.	30 Sec.	1 Min.	
1 Second	:03	:06	:09	:18	:04	:08	:12	:24	
2 Seconds	:06	:12	:18	:36	:08	:16	:24	:48	
3 Seconds	:09	:18	:27	:54	:12	:24	:36	1:12	
4 Seconds	:12	:24	:36	1:12	:16	:32	:48	1:36	
5 Seconds	:15	:30	:45	1:30	:20	:40	1:00	2:00	
6 Seconds	:18	:36	:54	1:48	:24	:48	1:12	2:24	
7 Seconds	:21	:42	:63	2:06	:28	:56	1:24	2:48	
8 Seconds	:24	:48	1:12	2:24	:32	1:04	1:36	3:12	
9 Seconds	:27	:54	1:21	2:42	:36	1:12	1:48	3:36	
10 Seconds	:30	1:00	1:30	3:00	:40	1:20	2:00	4:00	
12 Seconds	:36	1:12	1:48	3:36	:48	1:36	2:24	4:48	
14 Seconds	:42	1:24	2:06	4:12	:56	1:52	2:48	5:36	
16 Seconds	:48	1:36	2:24	4:48	1:04	2:08	3:12	6:24	
18 Seconds	:54	1:48	2:42	5:24	1:12	2:24	3:36	7:12	
20 Seconds	1:00	2:00	3:00	6:00	1:20	2:40	4:00	8:00	
25 Seconds	1:15	2:30	3:45	7:30	1:40	3:20	5:00	10:00	
30 Seconds	1:30	3:00	4:30	9:00	2:00	4:00	6:00	12:00	
35 Seconds	1:45	3:30	5:15	10:30	2:20	4:40	7:00	14:00	
40 Seconds	2:00	4:00	6:00	12:00	2:40	5:20	8:00	16:00	
45 Seconds	2:15	4:30	6:45	13:30	3:00	6:00	9:00	18:00	
50 Seconds	2:30	5:00	7:30	15:00	3:20	6:40	10:00	20:00	
55 Seconds	2:45	5:30	8:15	16:30	3:40	7:20	11:00	22:00	
1 Minute	3:00	6:00	9:00	13:00	4:00	8:00	12:00	24:00	1 Day
1.5 Minutes	3:30	7:00	10:30	21:00	6:00	12:00	18:00	36:00	
2 Minutes	6:00	12:00	18:00	36:00	8:00	16:00	24:00	48:00	2 Days
2.5 Minutes	7:30	15:00	22:30	45:00	10:00	20:00	30:00	60:00	
3 Minutes	9:00	18:00	27:00	54:00	12:00	24:00	36:00	72:00	3 Days
3.5 Minutes	10:30	21:00	31:30	63:00	14:00	28:00	42:00	84:00	
4 Minutes	12:00	24:00	36:00	72:00	16:00	32:00	48:00	96:00	4 Days
5 Minutes	15:00	30:00	45:00	90:00	20:00	40:00	60:00	120:00	5 Days
6 Minutes	18:00	36:00	54:00	108:00	24:00	48:00	72:00	144:00	6 Days
7 Minutes	21:00	42:00	63:00	126:00	28:00	56:00	84:00	168:00	7 Days
8 Minutes	1 Day	4 Days	3 Days	6 Days	32:00	64:00	96:00	192:00	8 Days
9 Minutes	27:00	54:00	81:00	162:00	36:00	72:00	108:00	216:00	9 Days
10 Minutes	30:00	60:00	90:00	180:00	40:00	80:00	120:00	240:00	10 Days
12 Minutes	36:00	3 Days	108:00	9 Days	48:00	96:00	144:00	288:00	12 Days
14 Minutes	42:00	82:00	126:00	252:00	56:00	112:00	168:00	336:00	14 Days
16 Minutes	2 Days	2 Days	6 Days	12 Days	64:00	128:00	192:00	384:00	16 Days
18 Minutes	54:00	108:00	162:00	324:00	72:00	144:00	216:00	432:00	18 Days
20 Minutes	60:00	5 Days	180:00	15 Days	80:00	160:00	240:00	480:00	20 Days
22 Minutes	66:00	132:00	270:00	540:00	88:00	176:00	264:00	528:00	22 Days
23 Minutes	69:00	138:00	207:00	414:00	92:00	184:00	276:00	552:00	23 Days
25 Minutes	75:00	150:00	225:00	450:00	100:00	200:00	300:00	600:00	25 Days
30 Minutes	90:00	180:00	270:00	540:00	120:00	240:00	360:00	720:00	30 Days
35 Minutes	105:00	210:00	315:00	630:00	140:00	280:00	420:00	840:00	35 Days
40 Minutes	5 Days	10 Days	15 Days	30 Days	160:00	320:00	480:00	960:00	40 Days
45 Minutes	135:00	270:00	405:00	810:00	180:00	360:00	540:00	1080:00	45 Days
50 Minutes	150 Hrs.	300 Hrs.	450 Hrs.	900 Hrs.	200:00	400:00	600:00	1200:00	50 Days
55 Minutes	165:00	330 Hrs.	495 Hrs.	990 Hrs.	220:00	440:00	660:00	1320:00	55 Days
1 Hour	180 Hrs.	15 Days	540 Hrs.	45 Days	240:00	480:00	720:00	1440:00	60 Days
1.5 Hours	270 Hrs.	540 Hrs.	810 Hrs.	1,620 Hrs.	360:00	720:00	1080:00	2160:00	90 Days
2 Hours	15 Days	30 Days	45 Days	90 Days	480:00	960:00	1440:00	2880:00	120 Days
2.5 Hours	450 Hrs.	900 Hrs.	1,350 Hrs.	2,700 Hrs.	600:00	1200:00	1800:00	3600:00	150 Days
3 Hours	540 Hrs.	45 Days	1,620 Hrs.	135 Days	720:00	1440:00	2160:00	4320:00	180 Days
3.5 Hours	630 Hrs.	1,260 Hrs.	1,890 Hrs.	157.5 Days	840:00	1680:00	2520:00	5040:00	210 Days
4 Hours	30 Days	60 Days	90 Days	180 Days	960:00	1920:00	2880:00	5760:00	240 Days
4.5 Hours	810 Hrs.	1,620 Hrs.	2,430 Hrs.	4,860 Hrs.	1080:00	2160:00	3240:00	6480:00	270:Days
5 Hours	900 Hrs.	75 Days	2,700 Hrs.	225 Days	1200:00	2400:00	3600:00	7200:00	300 Days
6 Hours	45 Days	90 Days	135 Days	270 Days	1440:00	2880:00	4320:00	8640:00	360 Days
7 Hours	1,260 Hrs.	105 Days	3,780 Hrs.	315 Days	1680:00	3360:00	5040:00	10080:00	420 Days
8 Hours	60 Days	120 Days	180 Days	360 Days	1920:00	3840:00	5760:00	11520:00	480 Days
9 Hours	1,620 Hrs.	135 Days	4,860 Hrs.	405 Days	2340:00	4680:00	7020:00	14040:00	585 Days
10 Hours	75 Days	150 Days	225 Days	450 Days	2400:00	4800:00	7200:00	14400:00	600 Days

Example of use: Assume that an action which takes place in 72 hours is to be shown on the screen in 30 seconds at sound speed (24 frames per second). Find the column headed 30 SECONDS at sound speed, look down this column until the action time of 72 hours is found, then look across to the left and find 6 minutes in the Interval column. The frames should be exposed at intervals of 6 minutes.



THESE FORMULAE YIELD APPROXIMATE VALUES WHEN APPLIED TO "THICK" LENSES AS USED IN AERIAL CAMERAS.

$$\frac{1}{u} + \frac{1}{v} = \frac{1}{f} \qquad v - f = \frac{f^2}{u-f} \qquad x \cdot x' = f^2 \qquad x' = fm$$

$$\frac{v-f}{f} = \frac{f}{u-f} \qquad m = \frac{-v}{u} = \frac{-y'}{y} \qquad x = \frac{f}{m} \qquad e = f\,\frac{(m+1)^2}{m}$$

u = DISTANCE FROM OBJECT TO LENS
v = DISTANCE FROM IMAGE TO LENS
f = FOCAL LENGTH OF LENS
m = LATERAL MAGNIFICATION
y = OBJECT HEIGHT
y′ = IMAGE HEIGHT
e = DISTANCE, OBJECT TO IMAGE
F = FIRST FOCAL POINT
F′ = SECOND FOCAL POINT
x = DISTANCE FROM OBJECT TO FIRST FOCAL POINT
x′ = DISTANCE FROM IMAGE TO SECOND FOCAL POINT

SIMPLE LENS EQUATION.

Since the mathematical relation between the distance of the object (u), the distance of the image (v) and the focal length (f) for any converging lens has been proven to be:

$$\frac{1}{u} + \frac{1}{v} = \frac{1}{f}$$

Where: u = object distance

v = image distance

f = focal length

If any two of these quantities are known, the third can be computed.

$$f = \frac{u \times v}{u + v}$$

$$u = \frac{f \times v}{v - f}$$

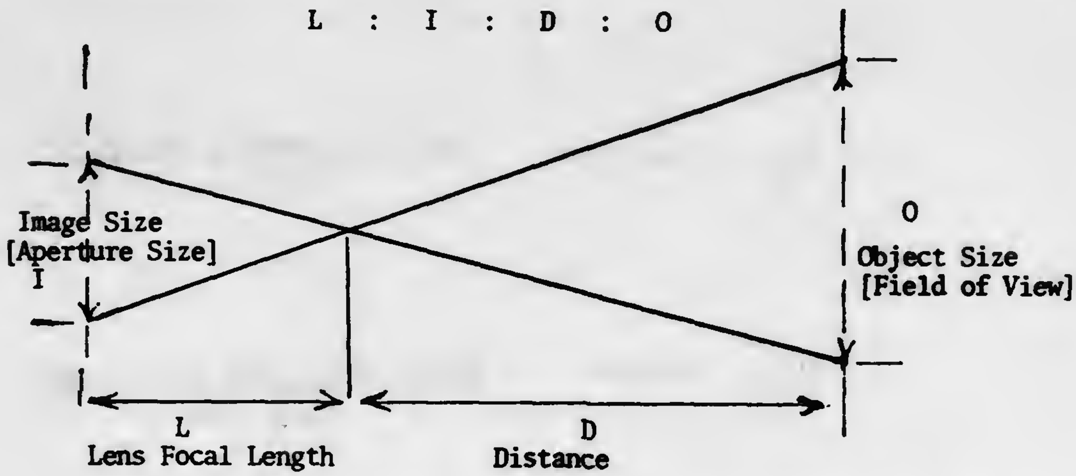
$$v = \frac{f \times u}{u - f}$$

As the image distance v becomes smaller, the object distance u becomes larger. This fact shows that as the object comes closer to the camera, the lens must be placed farther from the film in order for the object to be in focus. The closest that the object can come depends on the bellows extension of the particular camera.

PROPORTION FORMULA FOR SOLVING PHOTOINSTRUMENTATION PROBLEMS

A simple method for calculating lens focal length, image size or camera aperture dimensions, distanct to the object from the camera and object size in front of the camera.

L : I : D : O



To find one of the factors the other three must be known or assumed. Maintaining the same or like units is very important for accuracy, i.e., inches : inches, feet : feet, etc.

$$L : I : D : O \qquad \frac{\text{Lens}}{\text{Image}} = \frac{\text{Distance}}{\text{Object}}$$

L = Lens Focal Length [in inches]
I = Image Size [Frame Height or Width of Image Size or Aperture Size in inches].
D = Distance to the Object in feet
O = Object Size in front of the Camera [Field of View] in Feet. Height or Width depending on L--Lens Focal Length.

The following formulas are used to convert the L : I : D : O components.

$$L = \frac{D \times I}{O} \qquad \text{Lens Focal Length} = \frac{\text{Distance} \times \text{Image Size}}{\text{Object Size}}$$

$$I = \frac{L \times O}{D} \qquad \text{Image Size} = \frac{\text{Lens Focal Length} \times \text{Object Size}}{\text{Distance}}$$

$$D = \frac{O \times L}{I} \qquad \text{Distance} = \frac{\text{Object Size} \times \text{Lens Focal Length}}{\text{Image Size}}$$

$$O = \frac{D \times I}{L} \qquad \text{Object Size} = \frac{\text{Distance} \times \text{Image Size}}{\text{Lens Focal Length}}$$

Focal length of a lens is usually given in inches or centimeters. It may also be expressed as diopters as it often is done by Opticians.

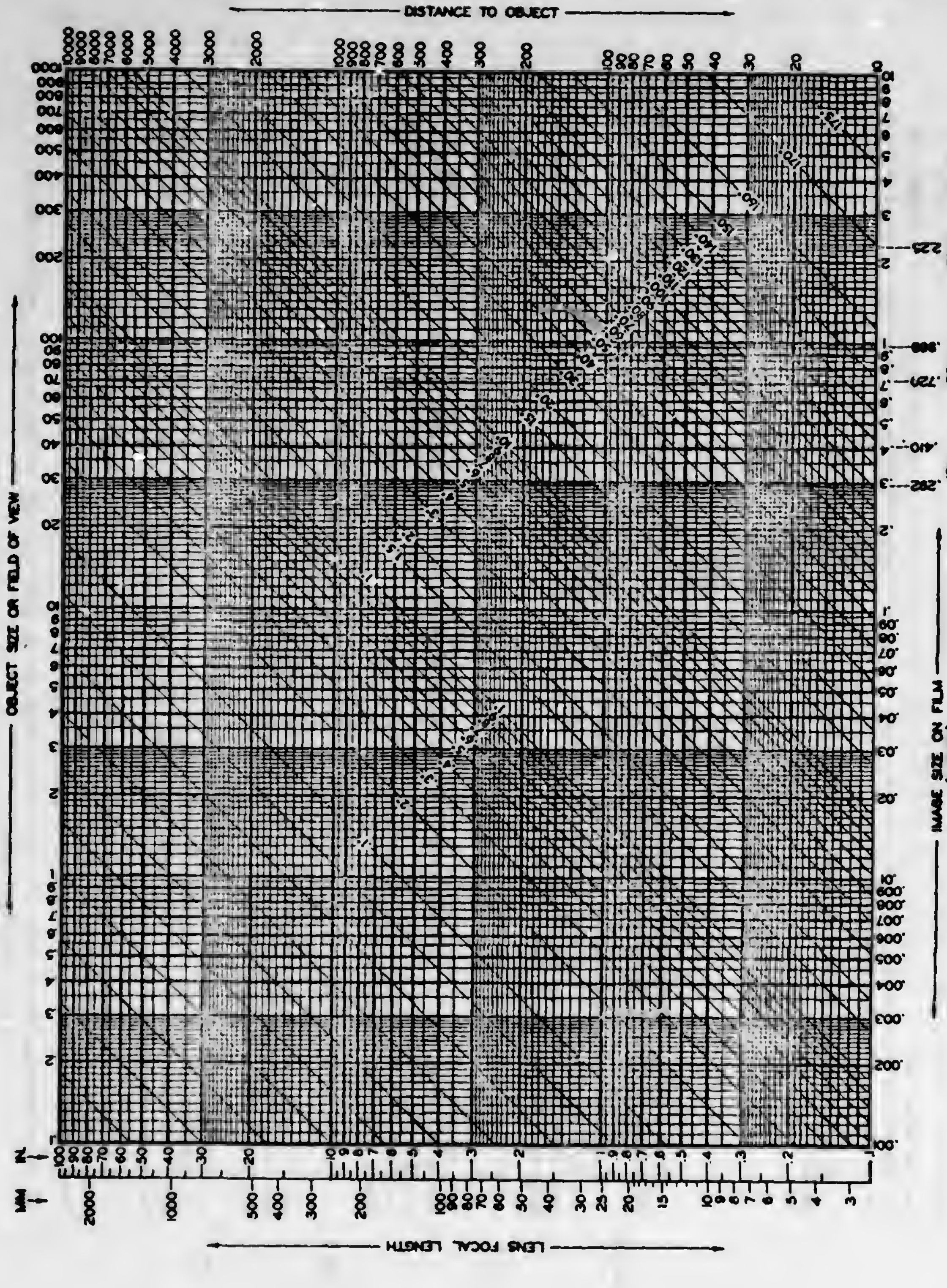
What is meant by diopter?

The refractive power of a lens having a focal length of 1 meter is equal to one diopter. A lens of focal length f meters has a power of 1/f diopters, the power in diopters is the reciprocal (or fraction) of the focal length (in meters). The power in diopters increases as the focal length is shortened. Opticians find diopters a useful measure since the power of two lenses used together is obtained by simply adding together their separate powers in diopters.

Example: The refractive power of a lens of 20cm focal length is 100/20 = 5 diopters. Conversely a lens of power 5 diopters has a focal length of 1/5 of 100cm., i.e. 20cm.

Positive lenses (which converge or concentrate light) are distinguished by a plus sign +, the lens in the example above has a power of + 5D.

LENS CHART

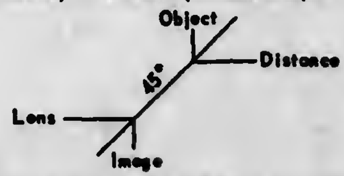


DISTANCE TO OBJECT
OBJECT SIZE OR FIELD OF VIEW
IMAGE SIZE ON FILM (INCHES)
LENS FOCAL LENGTH
IN
MM
70 MM
35 MM
16 MM

LENS CHART INSTRUCTIONS

Explanation: This chart is based on the proportion $\frac{\text{Lens}}{\text{Image}} = \frac{\text{Distance}}{\text{Object}}$. To find one of the factors, the other three must be known or assumed. The Lens and Image figures are on the left and bottom of the chart respectively and are given in inches (lens figures also given in millimeters.) Object size and Distance are on the top and right side respectively. These are not given a unit length, but any unit may be used as long as both are the same, that is, inches, feet, yards, meters, etc.

To get from one set of figures (Lens-Image relation) to the other (Distance-Object relation), use the 45 degree line represented by the lens angle lines.



The lens angles are used to determine the horizontal and vertical field of view when this information is required. Otherwise, remember it is the 45 degree line which is important in the use of the chart.

EXAMPLES

No. 1 Find the Image Size when photographing a 6" diameter object with a 10" lens at 2,500 feet.

The Object Size is .5 feet. Find .5 on the top of the chart and drop a line down to the line crossing through 2500 (feet) at the right. Follow the 45 degree line, where these two lines cross, diagonally to pick up the 10" lens horizontal line. Where these two cross, drop a line down to the Image Size. The Image Size is, therefore, .002".

No. 2 Find a lens to photograph a 20" high x 45" wide panel within a space of 50" with a 16mm camera.

First find which dimension of the panel will be limited by the 16mm aperture. This is the horizontal or 45" width. Next, find on the chart the cross over point of the Object and Distance lines, that is, 45" panel and 50" Distance. The diagonal line is about 48 degrees. The line representing the 16mm aperture width (.410) crosses this diagonal at a point which when carried to the left calls for a .46" lens. This is equivalent to a 12mm lens. If a 12mm lens is not available select a lens of the next shortest focal length, then recalculate the Distance for maximum panel image on the film. Also keep in mind that the distance to an object is based on the nodal point of the lens. In a confined space the bulk of the camera behind this point must be allowed for.

No. 3 Find the maximum distance a missile 6' long can be identified with a 20" lens. The minimum identifiable image on film being .003".

Find the cross over point between the horizontal 20" lens line and the vertical .003" image line. The diagonal line passing through this point will pick up the .6 line dropped down from the top of the chart. (The 6 ft. line was off the chart so we multiply the scale by ten. We must also multiply the Distance scale by ten to keep the correct proportion. The .6 line crosses the diagonal line at a point where the horizontal Distance line is 4,000 or times ten, 40,000 feet.

No. 4 Find the horizontal and vertical angles of a 1" 16mm lens.

Follow the horizontal line, representing a 1" lens, across the chart. It crosses the vertical line, representing the height of the 16mm aperture .292, at a point where the coinciding diagonal line reads 17. This is the vertical angle. Follow the 1" line to the right to pick up the vertical line representing the 16mm aperture width. It coincides with the diagonal at 24. This is the horizontal angle.

In using this chart, remember that the image size is confined by the width or height of the aperture used. The figures given on the chart are standard apertures and would possibly vary with different equipment, for instance, the academy 35mm aperture is smaller than the standard 35mm silent aperture.

The minimum image size is limited only by the resolution of the film and ability to visually pick out photographed targets on the film.

1 inch = 25.385 millimeters
1 millimeter = .0394 inches

DEPTH OF FI D

The extent of depth of field depends on the following:

a. The distance on which the lens is focused.

b. The focal length. [Note: Depth f Field is reduced if the focal length is increased].

c. The aperture. [Note: Depth of Field is reduced as the aperture is increased. Example: f/8 to f/2.8].

d. The criterian of the degree of sharpness required for a specific test.

An image is usually regarded as sufficiently sharp if a point in the object is reproduced by a circle of confusion of 1/250th inch. Inspected from the normal viewing distance of 10 in., this small circle appears to be a point. The diameter of the "Circle of Confusion" [The amount of tolerable sharpness is then said to be equal to 1/250th of an inch].

In cinematography the tolerance varies:

The "Circle of Confusion" is 1/500th of an inch for 35-mm film; 1/1000th of an inch for 16-mm film, and 1/2000 for 8-mm.

Depth of Field.--Is the extent of that zone in the field or scene in which the definition is satisfactorily sharp.

Depth of Focus.--Is a technical term relating to the properties of the lens and refers to the ability of a lens to define, with satisfactory sharpness upon the negative, the images of objects situated at varying distances. This is a fixed condition or quality of a lens.

Depth of Field.--May be increased by stopping down the lens diaphram.

FORMALAE FOR DEPTH OF FIELD

In order to be able to focus so that all objects between two selected distances from the lens are sharply defined, we must know:

1. What intermediate distance to focus on.
2. What aperture setting to use.

The intermediate distance to focus on can be determined from the following equation:

$$T_m = 2 \times \frac{T_v \times T_a}{T_v + T_a}$$

Where: T_m = Distance to which the focus is to be set.

T_v = The near point

T_a = The furthest point

Example: We are required to photograph two objects the nearest being 20 feet away, the furthest 180 feet away. What distance should the lens be focused on.

Answer: $T_m = \frac{2}{1} \times \frac{20 \times 180}{20 + 180}$

$= 2 \times \frac{3600}{200} = 36$ ft.

HYPERFOCAL DISTANCE

When set at infinity the depth of field extends from a point in front of the lens to infinity. The distance from the lens to this forward limit of sharpness is called the "Hyperfocal Distance." If the lens is focused on this Hyperfocal Distance, then everything between HALF this distance and INFINITY should be sharp.

The Hyperfocal Distance can be calculated from the following formula in which F is the focal length in inches:

n (f) = aperture number
e = diameter of circle of confusion
H = hyperfocal distance in feet

$$H = \frac{F \times F}{12_n} \times \frac{1}{e}$$

Example: What is the hyperfocal distance for a lens of 2 inches, F/2. The circle of confusion is 1/1000 of an inch.

Answer: $H = \frac{2 \times 2}{12 \times 2} \times 1000 = \frac{4}{24} \times \frac{1000}{1}$

$H = 167$ feet.

When the lens is focused on 167 feet everything from one half this distance (83 feet 6 inches) to infinity will be sharp.

$$\text{Hyperfocal Distance} = \frac{\text{Focal Length}^2 \times \text{Circle of Confusion}}{12 \times \text{f/stop}}$$

or

$$\text{Hyperfocal Distance} = \frac{F^2 \times C}{12n}$$

DEPTH OF FIELD AND HYPERFOCAL DISTANCE

Calculation of the Hyperfocal Distance makes it easy to calculate the depth of field for each distance with sufficient accuracy.

$$\text{DEPTH OF FIELD} = \frac{H \times T}{H + T} = \text{ND Near Distance}$$

$$= \frac{H \times T}{H - T} = \text{FD Far Distance}$$

Where H is the Hyperfocal Distance and T is the Distance on which the lens is focused.

$$\frac{\text{Hyperfocal Distance} \times \text{Distance Focused on}}{\text{Hyperfocal Distance} + \text{Distance Focused on}} = \text{Near Distance}$$

$$\frac{\text{Hyperfocal Distance} \times \text{Distance Focused on}}{\text{Hyperfocal Distance} - \text{Distance Focused on}} = \text{Far Distance}$$

Note: All quantities must be measured in the same units--inches, or feet, or yards.

C H A R T

MORE LIGHT ←

→ LESS LIGHT

F NUMBER	1.0	1.4	2.0	2.8	4.0	5.6	8	11	16	22
BRIGHTNESS AT FILM	512	256	128	64	32	16	8	4	2	1

ABOVE CHART GIVES THE RELATIVE BRIGHTNESS OF THE IMAGE BEING RECORDED ON THEFILM, FOR THE PRACTICAL RANGE OF F/SETTINGS.

<u>REMEMBER</u>: THE <u>LARGER</u> THE <u>F/NUMBER</u> THE <u>LESS</u> THE <u>LIGHT</u>.
THE <u>SMALLER</u> THE <u>F/NUMBER</u> THE <u>MORE</u> THE <u>LIGHT</u>.

How to Figure/Find Half-Stops

f-stops on scale represent full stop openings. When you move from f/8 to f/11 you have opened your aperture one full f-stop. The numbers outside the dial represent ½ f-stops. A move from f/8 to f/9 represents a ½ f-stop opening.

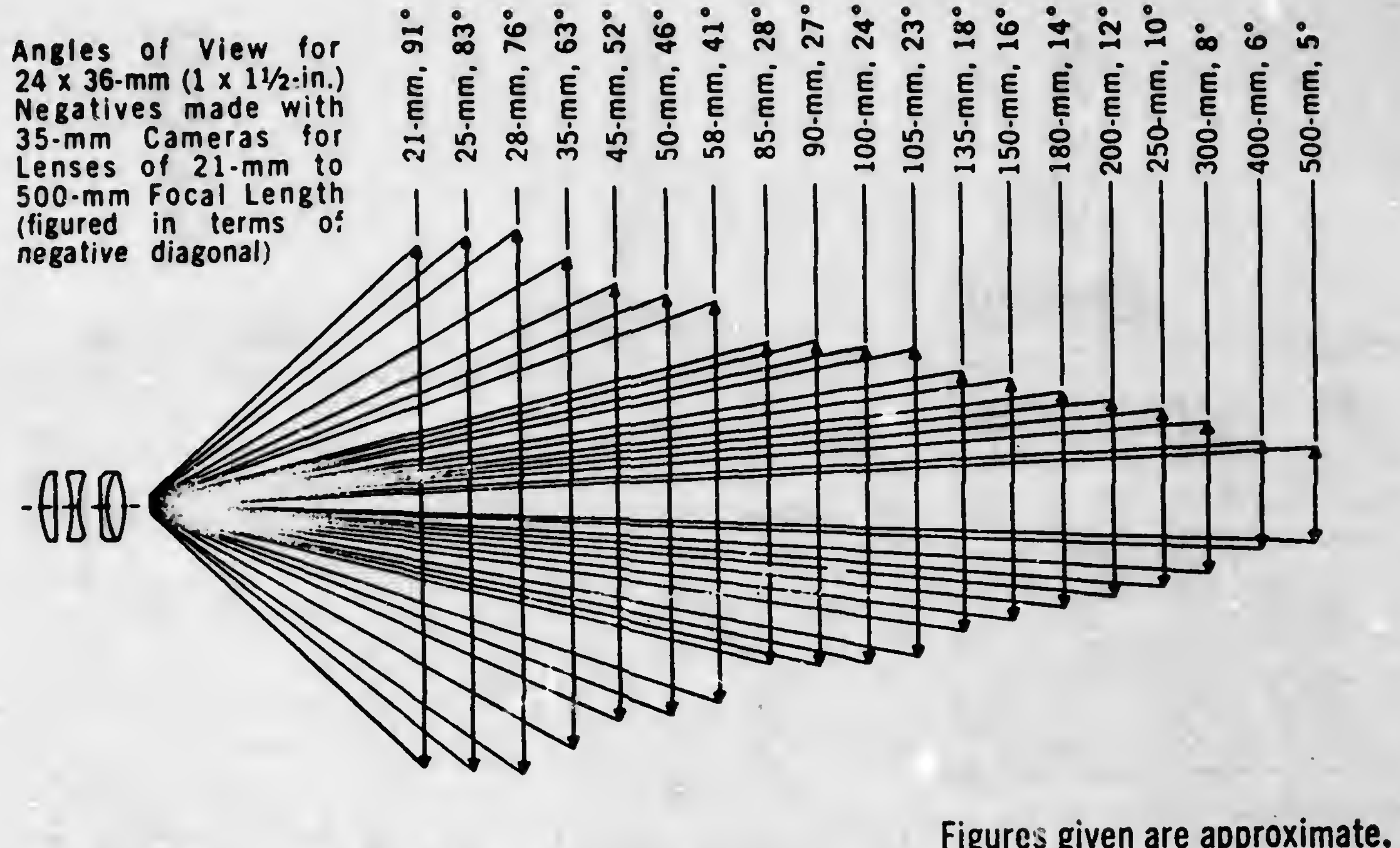
Full Stops	1.4	2	2.8	4	5.6	8	11	16	22	32	45	64
Half Stops	1.6	2.7	3.2	4.5	6.3	9	12.5	18	25	35	50	

An increase of one f-stop allows 100% (2 times) more light into your camera. An increase of ½ f-stop allows 50% more light into the camera. (The same system works in reverse when you want to decrease the amount of light coming into the camera.)

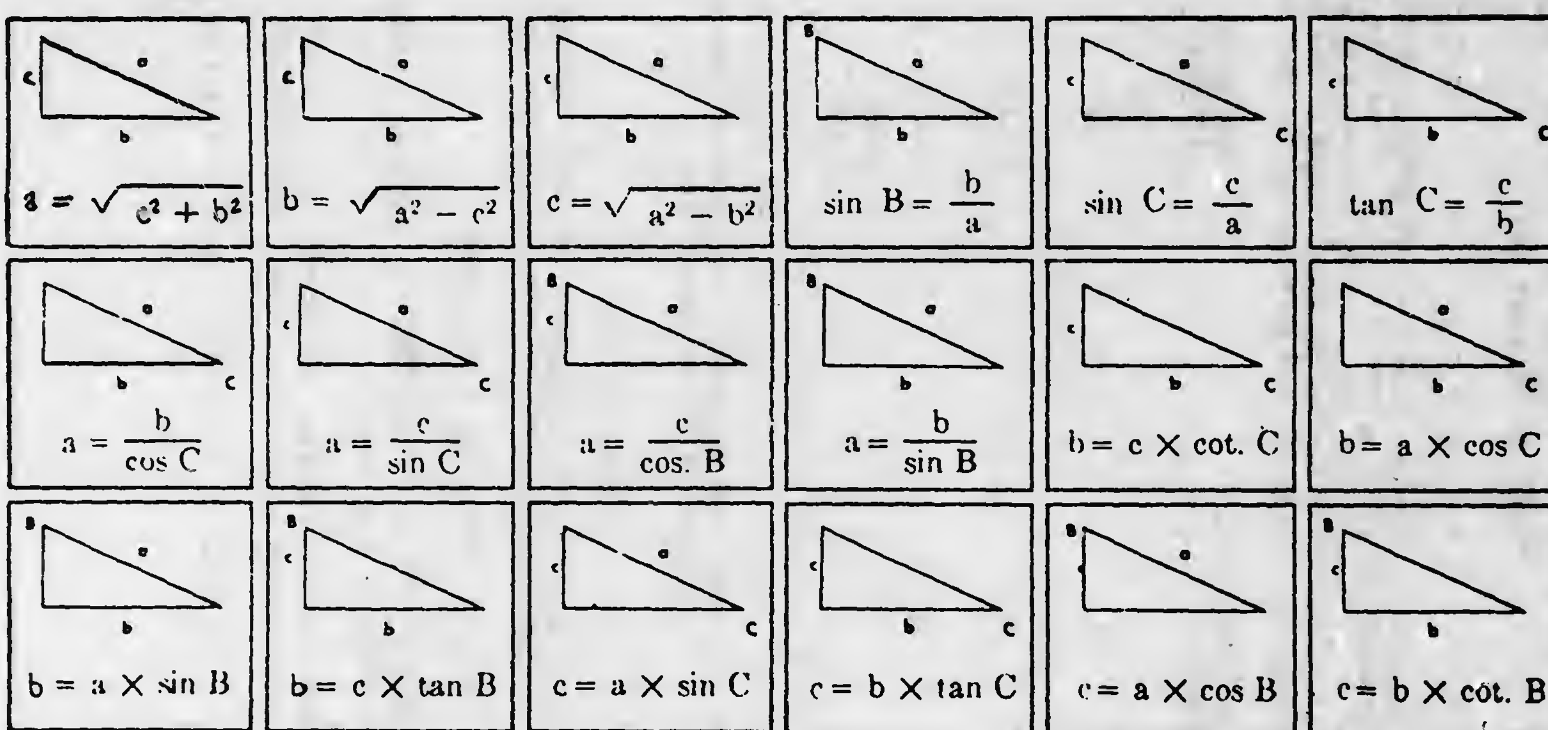
Field of view by Lens Focal Length - Full 16-mm Aperture .402" x .292"

Lens Focus (Feet)	10 mm Field of View	16 mm Field of View	25 mm Field of View	50 mm Field of View	75 mm Field of View	100 mm Field of View
2	1'4" x 1'11"	10" x 1'3	6" x 8"	3" x 4 1/4"		
3	2'1" x 2'11"	1'3" x 1'9"	9" x 12"	5" x 7"		
4		1'8" x 2'2"	1'1" x 1'6"	7' x 9 3/4"	4" x 6"	3 1/2 x 5"
5		2'3" x 3'1"	1'5" x 1'10"	8" x 11"	6" x 8"	4" x 5 1/2"
6		2'6" x 3'4"	1'6" x 2'0"	10" x 1'1"	7" x 9 3/4"	5" x 7"
8		3'3" x 4'5"	2'3" x 3'0"	1'1" x 1'6"	9" x 12"	7" x 9 3/4"
10	6'6" x 9'1"	4'6" x 6'2"	2'10" x3'9"	1'5" x 1'10"	1'0" x 1'4"	8" x 11"
15		6'9" x 9'3"	4'3" x 5'8"	2'1" x 2'10"	1'6" x 2'1"	1'0" x 1'4"
25	19'6" x 27'3"	11'3" x 15'5"	7'1" x 9'5"	3'6" x [illegible]'7"	2'6" x 3'6"	1'10" x 2'6"
50		22;6" x 30'10"	14'2" x 18'9"	7'1" x 9'2"	4'11" x 6'11"	3'8" x 5'1"
100					9'11" x 13'10"	7'4" x 10'2"

Lens Focal Length	Horizontal Angle [In Degrees]	Vertical Angle [In Degrees]
10mm	54.1	40.7
16mm	35.3	26.1
25mm	23.0	16.9
50mm	11.7	8.5
75mm	7.8	5.7
100mm	5.8	4.3
250mm	2.3	1.7
500mm	1.2	.8
1000mm	.6	.4



35-mm LENS ANGLES


$a = \sqrt{c^2 + b^2}$
$b = \sqrt{a^2 - c^2}$
$c = \sqrt{a^2 - b^2}$
$\sin B = \frac{b}{a}$
$\sin C = \frac{c}{a}$
$\tan C = \frac{c}{b}$
$a = \frac{b}{\cos C}$
$a = \frac{c}{\sin C}$
$a = \frac{c}{\cos. B}$
$a = \frac{b}{\sin B}$
$b = c \times \cot. C$
$b = a \times \cos C$
$b = a \times \sin B$
$b = c \times \tan B$
$c = a \times \sin C$
$c = b \times \tan C$
$c = a \times \cos B$
$c = b \times \cot. B$

EXPOSURE INCREASE WITH EXTENSION TUBES OR BELLOWS UNIT

The increase in exposure necessary when using extension tubes or bellows is based on the ratio between the length of the tube and the focal length of the lens. This can be easily determined by dividing the length of the extension tube by the focal length of the lens. The required increase in F/Stops can then be found in the chart below:

LENGTH OF TUBE DIVIDED BY FOCAL LENGTH OF THE LENS	INCREASE IN F/STOPS
.01	1/3
.02	2/3
.035	1
.075	1 2/3
1	2
1.25	2 1/3
1.50	2 2/3
2	3 1/2
3	4

EXAMPLE: A 25mm lens employing a 5mm extension tube would be calculated in the following manner:

$$\frac{5}{25} = 0.2$$

The chart shows that 0.2 requires an exposure increase of 2/3 F/Stop. This formula will work for any lens and any film size.

The following formula may also be used:

$$\frac{\text{DISTANCE OF LENS TO FILM SQUARED}}{\text{FOCAL LENGTH OF LENS SQUARED}} = \text{EXPOSURE INCREASE}$$

EXAMPLE: What is the exposure increase when a 2 inch [50mm] lens is used with a 2 inch [50mm] extension tube?

$$\frac{(2 + 2)^2}{2^2} = \frac{4^2}{4} = \frac{16}{4} = \text{4 X or 2 Stops Increase}$$

EXPOSURE INCREASE FOR EXTENSIONS

The following table gives the amount of exposure increase needed at various image magnifications when using extension tubes or bellows.

To find the amount of image magnification simply divide the image height by the subject height. In 35-mm cameras 1 inch may be taken as the image height if the narrow side of the frame is to be filled, while 1½ may be taken if the long dimension of the picture is to be filled.

MAGNIFICATION	EXPOSURE INCREASE
1/5 (1:5)	1.4 x
1/4 (1:4)	1.6 x
1/3 (1:3)	1.8 x
1/2 (1:2)	2.3 x
2/3 (1:1½)	2.8 x
3/4 (1:1⅓)	3.1 x
1:1 (image and subject same size)	4.0 x
1.5:1	6.3 x
2:1	9.0 x
3:1	16 x
4:1	25 x
5:1	36 x
6:1	49 x

Easiest way to calculate the increased exposure when setting diaphragm and shutter speeds is to divide the Exposure Index for your film by the Exposure Increase factor.

EXPOSURE INCREASE for BELLOWS EXTENSIONS

INCHES

1	1.2	1.4	1.6	2	2.5	2.8	3.2	4	4.5	5.6	6.3	8

To use the above chart locate a number in it which is equal or close to the focal length of the lens you are using. Lens focal length is usually found engraved on the front of the lens mount.

Now count the number of spaces you have to go to the right until you reach the amount of total extension you are using. Total extension is the distance from the lens diaphragm to the film.

The number of spaces you have to go to the right will determine the amount of exposure increase necessary. This is given in the table below.

No. of boxes	Exposure Factor	No. of boxes	Exposure Factor
1	1½	6	8
2	2	7	12
3	3	8	16
4	4	9	24
5	6	10	32

COLOR FILTER DESIGNATIONS

(Approximate equivalents among leading brands)

*	Ednalite	H&H**	Decamired
81C	CTY 4	C-¼	R4
81D	CTY 5	C-½	R5
81EF	CTY 6	C-1	R5
82	CTB 1	B-⅛	B1
82A	CTB 2	B-¼	B2
82B	CTB 3	B-½	B3
82C	CTB 4	B-½	B5
Sky-light 1A	Chrome-Haze	UV-Haze	R1

*Kodak, Enteco, Accura, Tiffen and Walz

**Harrison & Harrison

NOTE: The equivalents given in this table are approximate.

COLOR FILTER DESIGNATIONS

(Approximate equivalents among leading brands)

*	Ednalite	H&H**	Decamired
85	Chrom-A	C-4	R11
85B	Chrome B	C-5	R13
85C	Chrome C	C-2	R8
80B	Chrom-Blue	B-4	B11
80C	Chrom-Blue	B-2	B8
81	CTY 1	C-⅛	R2
81A	CTY 2	C-⅛	R3
81B	CTY 3	C-¼	R3.5

*Kodak, Enteco, Accura, Tiffen and Walz

**Harrison & Harrison

NOTE: The equivalents given in this table are approximate.

KODAK WRATTEN NEUTRAL DENSITY FILTERS NO. 96

NEUTRAL DENSITY	PER CENT TRANSMISSION	FILTER FACTOR	INCREASE IN EXPOSURE (STOPS)
0.1	80	1 1/4	1/3
0.2	63	1 1/2	2/3
0.3	50	2	1
0.4	40	2 1/2	1 1/3
0.5	32	3	1 2/3
0.6	25	4	2
0.7	20	5	2 2/3
0.8	16	6	2 2/3
0.9	13	8	3
1.0	10	10	3 1/3
2.0	1	100	6 2/3
3.0	0.1	1,000	10
4.0	0.01	10,000	13 1/3

EXPOSURE METER INSTRUCTIONS

There are two main classifications of exposure meter. A meter measuring the intensity of the light incidental or falling on a subject is known as an incident light meter, while a meter measuring light reflected from a subject is designated a reflectance or reflected light meter. In practical use, the light receptor or photoelectric cell of the incident meter is pointed at the camera from the subject position, whereas the cell on the reflected light meter is pointed at the subject from the camera position or close-up.

The instructions that follow are for using the Spectra Director, Brockway, or Sekonic Studio S Incident Light Meter and the Weston Master IV Reflected Light Meter.

I. Using the Spectra Director, Brockway, or Sekonic Studio S Meter:

Hold the dial with finger and move the ASA setting button until the correct ASA number appears in the index window. After setting the film index, hold the meter close to the subject and point the photosphere at camera or the position which the camera will occupy when taking the picture. Be sure the same light falls on photosphere as falls on the subject. The photosphere may be swiveled to face camera allowing the reading to be taken from the side. Read the needle indication on the meter dial. If the needle reads more than f/16, or 1M, insert Bright Slide #1 behind photosphere. When the bright light slide is in, rotate the dial until Red IN pointed insert points to the number on the dial scale which corresponds to the number indicated by needle. On the lower half of the dial scale adjacent to each other will appear all the combinations of shutter speeds and f/stops for correct exposure. Any combination of shutter speed and f/stop which are matched together may be used. When the bright light slide is out of the meter, use the White OUT pointed insert, and read the meter in the same manner as before.

There are three attachments which may be used over the photoelectric cell:

1. A photosphere used for incident exposure determination.
2. A photodisk used for lighting, contrast control and for checking illumination on animation, title or copy work.
3. A photogrid to convert meter for reflected light readings and Brightness range control.

Taking readings with the Spectra Director, Brockway, or Sekonic Studio S meter:

1. At Camera:
A reading is taken from camera position by pointing the photosphere or light cell toward the camera if the light condition is similar to that falling on the subject.

2. At Subject:
The light cell is pointed at the camera position or the position where the camera will be when taking the picture.

3. Two Position:
Point the light cell from subject position toward the light source and take reading, and then take another reading by directing the cell at the camera. Use the average of the two readings for the exposure. To find the average, place the appropriate "in" or "out" pointer midway between the highest and lowest readings.

4. High-Low:
Hold the meter light cell in the area of the scene receiving the greatest amount of light and take a reading. Take a second reading in the area, receiving the least light. Use the average of the two readings for the exposure. The average reading may be modified to favor the lighter or darker portion of the scene as above.

Using the Brockway, Spectra Director, or Sekonic Studio S meter as a Direct-Reading Meter:

The three slides supplied with the meter allow its use as a direct reading meter. These direct reading slides preset the meter for a particular film and shutter speed combination as follows:

A. For Still Photography Use:

SLIDE 1	ASA 10	1/50
	ASA 25	1/100
	ASA 50	1/200
SLIDE 2	ASA 16	1/50
	ASA 32	1/100
	ASA 64	1/200
SLIDE 3	ASA 40	1/50
	ASA 80	1/100
	ASA 100	1/125
	ASA 200	1/250
SLIDES OUT	ASA 10(16)	1/2
	ASA 200	1/50
	ASA 400	1/100
	ASA 800	1/200
	ASA 1000	1/250

B. For motion picture use only:

SLIDE 1	ASA 10	1/50
SLIDE 2	ASA 16	1/50
SLIDE 3	ASA 40	1/50
SLIDES OUT	ASA 200	1/50

To use meter for direct reading, point the light cell for a reading and note the f/stop indicated where the needle stops. This is your correct f/stop. Set your camera for f/stop and make exposure. The calculating dial is not used.

Using the photodisk for light contrast control:

Insert the flat photodisk over the meter cell. Turn on main light, hold meter at subject position with photodisk pointed at the main or key light and read intensity of light on meter scale. Turn on fill light (shield disk from main light with hand) and read light intensity. Divide the intensity of main light by intensity of fill-in light to get contrast ratio.

EXAMPLE: Main light 500
Fill-in light 250

$$\text{The lighting contrast ratio} = \frac{500}{250} \text{ or } 2 \text{ to } 1$$

With the bright slide IN, the needle must be multiplied by 30 for a foot candle reading; while used with the slide OUT, the needle will read directly in foot candles.

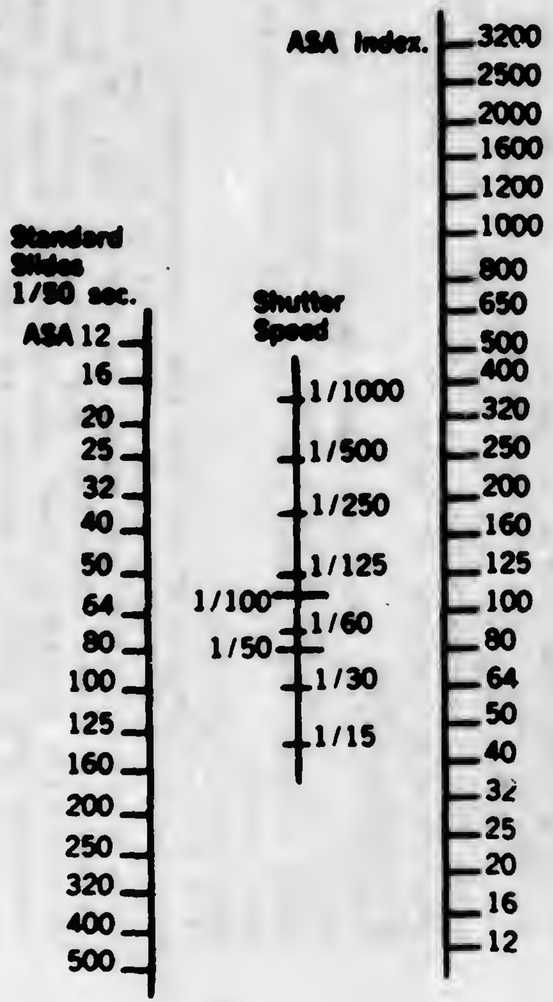
Using the photodisk in copy work:

A most convenient method of measuring illumination of copy or title work is to use the photodisk on the meter. Place the meter flat against the material to be shot and move around the test evenness of illumination.

Special ASA indexes for copying films are published for meter readings taken from a white surface placed over copy work. These indexes give acceptable exposure when readings are made with a reflected light meter: however, these indexes must be converted for use with the photodisk on incident meter. To convert the ASA index of a meter reading of a white surface for use with a photodisk the white surface index reading should be multiplied by 5, e.g., ASA index for meter reading of white surface. 50 x 5 = 250 or corrected ASA index for use with photodisk.

II. Using the Weston Master IV Meter:

1. Set the film exposure index by moving the exposure index knob until the correct exposure index or film speed appears in the EXPOSURE INDEX WINDOW.
2. Aim the meter at subject or scene and release POINTER LOCK on upper side of meter by sliding POINTER LOCK to right. When the needle comes to rest, lock it in position by sliding



Other Speeds:

Although the standard ASA slides are for 1/50 second, each slide may be used for a variety of ASA and shutter-speed combinations.

The Spectra Slide Nomograph indicates which slide to use for different shutter speeds.

SPECTRA SLIDE NOMOGRAPH

To use: 1. Run a line from your film ASA (right column) through selected shutter speed (center column).

2. The correct standard slide to use is indicated at point where line crosses left column.

pointer lock to left. Note the reading on LIGHT SCALE.

3. Point the arrow on calculator dial at the reading noted on the LIGHT SCALE by turning the large knurled outer section of the EXPOSURE CONTROL DIAL.
4. Set the camera with any combination of shutter speed and f/stop that appear opposite each other on the EXPOSURE CONTROL DIAL. All the combinations will give the same exposure.

The Weston Meter has two sliding light value scales to provide correct readings under both extremely or dim light conditions. Movement of the baffle over the photocell automatically changes the scale. The baffle should be opened when the light reading is less than 24, and the low light scale will come into position.

Taking readings with the Weston Master IV:

1. Camera Position
   Hold the meter with the photocell aimed toward the scene from camera position and tilt the meter at an angle slightly downward so that your line of sight passes over the front edge of the pointer lock. This will exclude sky areas which would tend to inflate reading and cause underexposure. Set arrow on dial to light reading indicated on light value scale.
2. Close-up
   The meter reading should be taken about 6" from subject and no further away than the subject's smallest dimension. Set the arrow on dial to this reading. When a meter reading is taken from a person's face, set the "C" position on dial to light reading instead of arrow.
3. Brightness Range
   Take two close-up readings, one from the darkest part of the object or scene and another from the lightest area. Set the arrow between the highest and lowest reading to get an average reading.
4. Substitution Method
   If a subject is not accessible for close-up reading, substitute readings of nearby similar objects in the same light, e.g., trees for trees and rocks for rocks, etc. The palm of the hand is a good substitute for a person's face, but the "C" position should be used instead of the arrow to set dial. A neutral gray card may be used to take a reading by placing the gray card halfway between the subject and light source and reading the reflected light. Set arrow to light reading indicated.

U and O positions:

Black and white photographic film has a range within which it reproduces the brightness of objects in a scene in tones of gray from white to black. When a meter reading is taken from camera position, the reading is the average brightness of the entire scene.

The U and O positions on the exposure dial are the limits of correct exposure for black and white film. If the highest and lowest readings are within the U and O positions on the dial, both the high and low brightness values will be included on the film. Should either reading be outside of either of these markings, the range of the film value scale will be exceeded. The dial may be moved to favor either the brightest or darkest readings.

A and C positions:

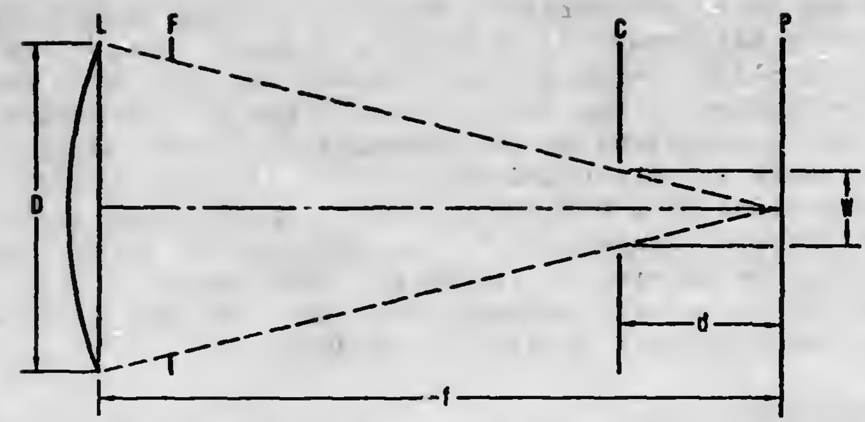
These positions represent a brightness ratio of four to one. When using color film, attempt to have primary colors of interest fall between the A-C positions for most faithful rendering of these colors.

With black and white film, the "A" is used to indicate "Absence of Contrast" and "C" "Contrast." The A position halves normal exposure for flat scenes, e.g., landscapes with no extreme contrast between highlights and shadows. The C doubles normal exposure as indicated by the 2X. This position is used for scenes of extreme contrast, e.g., back-lighted scenes.

Taking Incident Light readings
with Weston Master IV:

When the illumination is relatively low, open meter baffle and slip the Invercone into place over photoelectric cell. If level of illumination is high, close baffle and slip Invercone into place over baffle. To take a reading, stand at the subject you are going to photograph and point Invercone at the camera or the spot from which you are going to take the picture. With an inaccessible subject, the reading may be t ken at the camera providing the illumination is the same as that on the subject.

> NOTE: The photographic process contains so many variables, from exposure to the final printing process, that any photographer may find a certain consistent error in his meter readings. It is often necessary to determine an individual correction factor and modify the film speed setting on the meter to compensate for errors in handling the meter or camera, processing or printing the pictures.



INSERT DIMENSIONS IN THE FOLLOWING EQUATIONS TO DETERMINE THE IMAGE MOTION STOPPING EFFICIENCY OF FOCAL PLANE SHUTTERS.

$$n = \frac{100W}{W + \frac{d}{F}} \qquad R \approx \sqrt{\frac{n}{100}\,R}$$

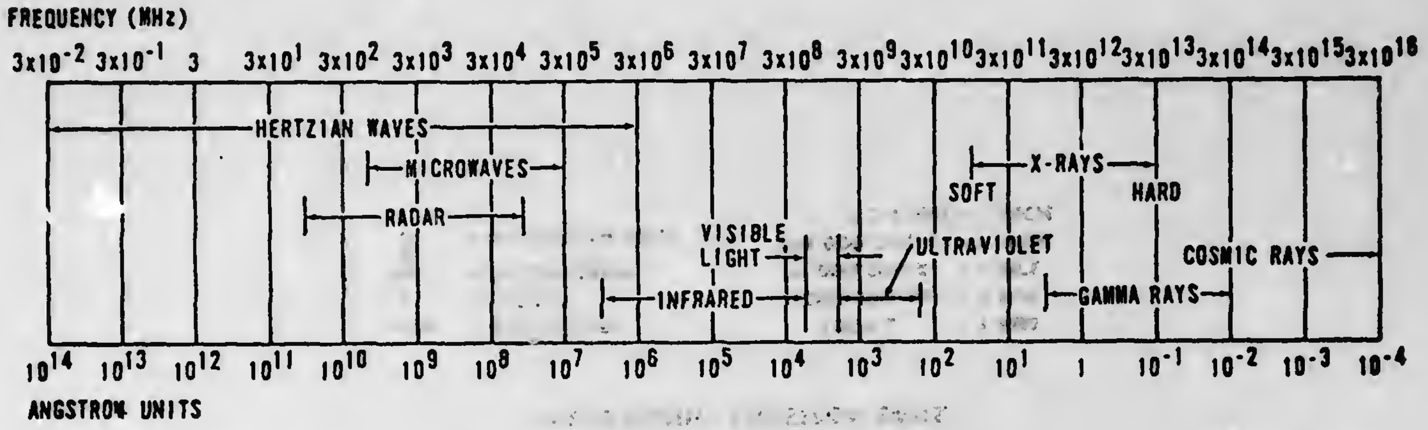
C = CURTAIN OF FOCAL PLANE SHUTTER
D = DIAMETER OF THE LENS APERTURE
d = DISTANCE BETWEEN SHUTTER AND PHOTOGRAPHIC MATERIAL (INCHES)
F = DIAPHRAGM STOP OR f - NUMBER
f = FOCAL LENGTH OF LENS
L = CAMERA LENS
P = PLANE OF PHOTOGRAPHIC MATERIAL
W = WIDTH OF SLIT IN SHUTTER CURTAIN (INCHES)
n = IMAGE-STOPPING EFFICIENCY IN PERCENT
R' = RESOLUTION WITH A SHUTTER EFFICIENCY (n) ($50\% \leq n \leq 100\%$)
R = RESOLUTION WITH A 100% EFFICIENT SHUTTER.

$$\text{EXPOSURE TIME (SEC)} = \frac{\text{SLIT WIDTH (INCHES)}}{\underline{\text{SLIT}}\ \text{VELOCITY (INCHES/SECOND)}}$$

FOR STATIONARY SLIT STRIP FILM CAMERA:

$$\text{EXPOSURE TIME (SEC)} = \frac{\text{SLIT WIDTH (INCHES)}}{\underline{\text{FILM}}\ \text{VELOCITY (INCHES/SECOND)}}$$

FOCAL PLANE SHUTTER IMAGE MOTION STOPPING EFFICIENCY.



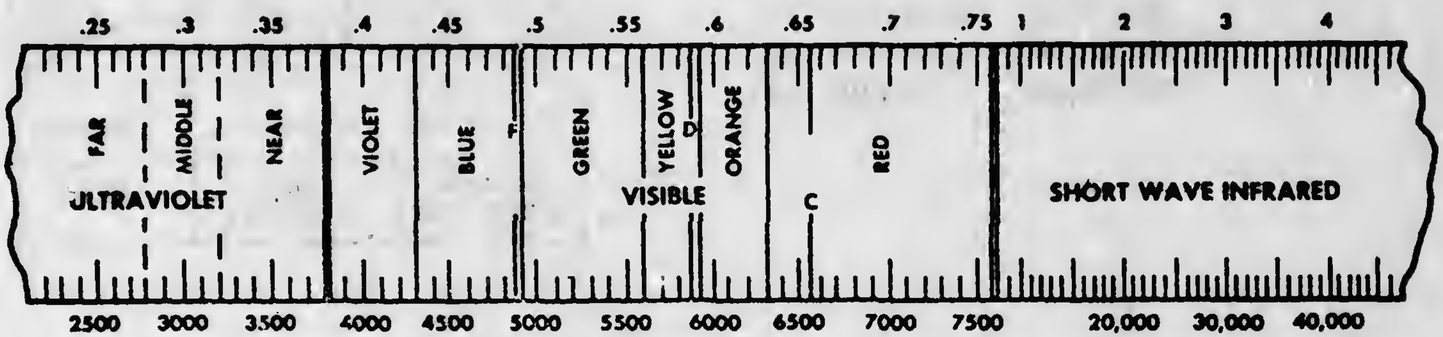
COLOR	FREQUENCY HERTZ	WAVELENGTH MICRONS
(INFRARED)	BELOW 4.0×10^{14}	GREATER THAN 0.75
RED	4.0 - 4.8	0.75 - 0.63
ORANGE	4.8 - 5.0	0.63 - 0.60
YELLOW	5.0 - 5.2	0.60 - 0.58
GREEN	5.2 - 5.9	0.58 - 0.51
BLUE	5.9 - 6.5	0.51 - 0.46
VIOLET	6.5 - 7.5	0.46 - 0.40
(ULTRAVIOLET)	OVER 7.5	BELOW 0.40

SPEED OF LIGHT = 3×10^{10} CM/SEC
1 MICRON = 10^{-4} CM = 10^{-6} METERS
1 NANOMETER (NM) = 10^{-9} METERS
1 ANGSTROM UNIT = 10^{-8} CM = 10^{-10} METERS

ELECTROMAGNETIC WAVE SPECTRUM.

OPTICAL SPECTRUM

MICRON



WAVELENGTH – ANGSTROM UNITS

mm	= MILLIMETER	1000 μ	= 1 MM
μ	= MICRON	1,000,000 mμ	= 1 MM
mμ	= MILLIMICRON	10,000,000 A	= 1 MM
Å	= ANGSTROM UNIT	254,000,000 A	= 1 INCH
		25.4 MM	= 1 INCH

CELSIUS-FAHRENHEIT-KELVIN-RANKIN TEMPERATURE CONVERSION

°K = °C + 273.16
°R = °F + 459.69
°F = 9/5°C + 32 OR 1.8 (°C + 17.8)
°C = 5/9 (°F − 32) OR 0.56 (°F − 32)

C ←	F↓C	→ F	C ←	F↓C	F	C ←	F↓C	→ F
-62.2	-80	-112.0	+ 1.7	+ 35	+ 95.0	+51.7	+125	+257.0
-56.7	-70	- 94.0	4.4	40	104.0	54.4	130	266.0
-51.1	-60	- 76.0	7.2	45	113.0	57.2	135	275.0
-45.6	-50	- 58.0	10.0	50	122.0	60.0	140	284.0
-40.0	-40	- 40.0	12.8	55	131.0	62.8	145	293.0
-34.4	-30	- 22.0	15.6	60	140.0	65.6	150	302.0
-31.7	-25	- 13.0	18.3	65	149.0	68.3	155	311.0
-28.9	-20	- 4.0	21.1	70	158.0	71.1	160	320.0
-26.1	-15	+ 5.0	23.9	75	167.0	73.9	165	329.0
-23.3	-10	14.0	26.7	80	176.0	76.7	170	338.0
-20.6	- 5	23.0	29.4	85	185.0	79.4	175	347.0
-17.8	0	32.0	32.2	90	194.0	82.2	180	356.0
-15.0	+ 5	41.0	35.0	95	203.0	85.0	185	365.0
-12.2	10	50.0	37.8	100	212.0	87.8	190	374.0
- 9.4	15	59.0	40.6	105	221.0	90.6	195	383.0
- 6.7	20	68.0	43.3	110	230.0	93.3	200	392.0
- 3.9	25	77.0	46.1	115	239.0			
- 1.1	30	86.0	48.9	120	248.0			

FRACTIONAL INCH EQUIVALENTS IN DECIMALS AND MILLIMETERS

FRAC.	DEC.	MM	FRAC.	DEC.	MM	FRAC.	DEC.	MM	FRAC.	DEC.	MM
1/64	.0156	.397	7/64	.265	6.75	33/64	.5156	13.1	49/64	.7656	19.45
1/32	.0312	.79	9/32	.2812	7.14	17/32	.531	13.49	25/32	.781	19.84
3/64	.0468	1.19	10/64	.2968	7.54	35/64	.5468	13.89	51/64	.7968	20.24
1/16	.0625	1.59	5/16	.3125	7.94	9/16	.5625	14.29	13/16	.8125	20.64
5/64	.078	1.98	21/64	.328	8.33	37/64	.578	14.68	53/64	.828	21.03
3/32	.0937	2.38	11/32	.3437	8.73	19/32	.5937	15.08	27/32	.8437	21.43
7/64	.109	2.77	23/64	.359	9.13	39/64	.609	15.48	55/64	.859	21.83
1/8	.125	3.17	3/8	.375	9.52	5/8	.625	15.87	7/8	.875	22.22
9/64	.1406	3.57	25/64	.3906	9.92	41/64	.6406	16.27	57/64	.8906	22.62
5/32	.156	3.97	13/32	.406	10.32	21/32	.656	16.7	29/32	.906	23.02
11/64	.1718	4.37	27/64	.4218	10.72	43/64	.6718	17.06	59/64	.9218	23.42
3/16	.1875	4.76	7/16	.4375	11.11	11/16	.6875	17.46	15/16	.9375	23.81
13/64	.203	5.16	29/64	.453	11.51	45/64	.703	17.86	61/64	.953	24.21
7/32	.2187	5.56	15/32	.4687	11.91	23/32	.7187	18.26	31/32	.9687	24.61
15/64	.234	5.95	31/64	.484	12.30	47/64	.734	18.65	63/64	.984	25.0
1/4	.25	6.35	1/2	.5	12.7	3/4	.75	19.05	1	1.0	25.4001

CONVERSION FACTORS

MULTIPLY	BY	TO GET
ACRE	43.56×10^{3}	SQUARE FEET
ANGSTROM	3.937×10^{-9}	INCHES
ANGSTROM	10^{-10}	METERS
ANGSTROM	10^{4}	MICRONS
ATMOSPHERE	14.7	POUNDS/SQUARE INCH
BTU	778.0	FOOT POUNDS
CANDLE	1.0	LUMENS/STERADIANS
CANDLE/CM^2	3.1416	LAMBERTS
CANDLE/METER^2	6.45×10^{-4}	CANDLES/INCHES^2
CANDLE/METER^2	0.292	FOOT LAMBERTS
CANDLE/METER^2	3.142×10^{-4}	LAMBERTS
CUBIC FEET	7.481	GALLONS
CUBIC FEET	28.32	LITERS
CUBIC FEET	62.36	POUNDS WATER
DEGREES	17.45×10^{-3}	RADIANS
FATHOM	6.0	FEET
FEET	0.3048	METERS
FEET PER SECOND	1.097	KILOMETERS/HOUR
FEET WATER	43.35×10^{-2}	POUNDS/SQUARE INCH
FOOT CANDLES	1.0	LUMEN INCIDENT/FEET^2
FOOT CANDLES	10.764	METER CANDLES
FOOT POUNDS	13.83×10^{-2}	KILOGRAM METERS
FURLONG	40.0	RODS
GALLON	231.0	CUBIC INCHES
GALLON	3.785	LITERS
GALLON	8.3356	POUNDS WATER
GRAMS	15.43	GRAINS
HP	0.707	BTU/SECONDS
HP	0.746	KILOWATTS
INCHES	2.54	CENTIMETERS
INCHES	25.4	MILLIMETERS
INCHES MERCURY	1.133	FEET WATER
INCHES MERCURY	49.12×10^{-2}	POUNDS/SQUARE INCH
KILOGRAMS	2.205	POUNDS
KILOMETERS	62.14×10^{-2}	STATUTE MILES
KNOTS	1.688	FEET/SECOND
KNOTS	1.8532	KM/HR
KNOTS	1.152	MPH
LEAGUE	3.0	NAUTICAL MILES
LUMEN	14.96×10^{-4}	WATTS OF MONOCHROMATIC GREEN LIGHT @555 NANOMETERS
LUX	9.29×10^{-2}	FOOT CANDLES
LUX	1.0	METER CANDLES

CONVERSION FACTORS (CONTINUED)

MULTIPLY	BY	TO GET
METERS	3.281	FEET
METERS	39.37	INCHES
METER CANDLE	1.0	LUMEN/METER^2
MICRON	3.94×10^{-5}	INCHES
MICRON	10^{-3}	MILLIMETERS
MICRORADIAN	0.206	SECONDS OF ARC
MILLIMETER	3.28×10^{-3}	FEET
MILLIMETER	39.37×10^{-3}	INCHES
MILLIMETER	1×10^{3}	MICRONS
MPH	1.609	KILOMETERS/HOUR
MPH	0.869	KNOTS
MPH	1.467	FEET/SECOND
NAUTICAL MILES	1.852	KILOMETERS
NAUTICAL MILES	1.15	STATUTE MILES
RADIANS	57.3	DEGREES
RADIANS	3437.747	MINUTES
RODS	5.5	YARDS
SECONDS OF ARC	4.848	MICRORADIANS
SQUARE FEET	9.29×10^{-2}	SQUARE METERS
SQUARE INCHES	6.452	SQUARE CENTIMETERS
SQUARE MILES	640	ACRES
SQUARE MILES	27.88×10^{6}	SQUARE FEET
SQUARE MILES	2.59	SQUARE KILOMETERS
SQUARE YARDS	83.61×10^{-2}	SQUARE METERS
STATUTE MILES	5280	FEET
STATUTE MILES	8.0	FURLONGS
STATUTE MILES	1.609	KILOMETERS
YARDS	91.44×10^{-2}	METERS

PHOTOMETRIC UNITS

QUALITY	SYMBOL	DIMENSION	UNIT
FLUX	F	LUMEN	LUMEN*
INTENSITY	I	LUMEN/SOLID ANGLE	CANDLE POWER
BRIGHTNESS	B	LUMEN/SOLID ANGLE/UNIT AREA	CANDLE/METER^2
ILLUMINATION	E	LUMEN/UNIT AREA	LUX

*1 LUMEN = AVERAGE LIGHT EMISSION, AS VISUALLY DETERMINED, OF ONE (1) CANDLE INTO UNIT SOLID ANGLE (IN STERADIANS). ONE LUMEN IS EQUIVALENT TO 0.001496 WATTS OF MONOCHROMATIC GREEN LIGHT HAVING A WAVELENGTH OF 546 NANOMETERS.

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